The Journal of Occupational Diseases and Traumatic Surgery

Industrial Medicine

for

Physicians and Surgeons in Industry

Volume 9 APRIL, 1940 Number 4

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Industrial Workers of 1960
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—Following Carbon Monoxide Poisoning—

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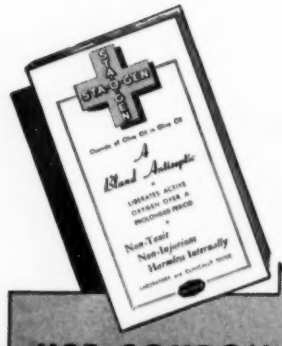

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DR. McCORD'S "Industrial Workers of 1960" embraces a subject that is certain to be of increasing importance — sharply accentuated by the imminent 1940 Census. Much has been written about population trends during the last decade, and much more will be written during the next. These are a matter of considerable interest to the studious, and DR. McCORD'S current addition to the growing literature has the thoughtful treatment to appeal to all who are interested and, by its easy readability, add to their number. Some of the trends he discusses have become rather recently operative. The problem of the older worker, for example, which seemed to have reached its most serious stage in the early 1930's, is easing rapidly; " . . . the supposed superiority of the young worker is a myth . . . older workers more and more, for several decades to come, will be found in industry." And a present problem, that of the young people who want employment and can't find it now, appears also headed toward solution: " . . . the time will come when there may be keen competition for young workers, since the total number available will be curtailed." DR. McCORD concludes: "For all of this prospect we should rejoice, but there are problems ahead." Apropos of another trend, which may or may not develop into one of the problems, is the following from a recent editorial in *Chicago Daily News*: "As the insurance experts phrase it: 'A surplus of women in the American

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population has become a certainty in the future because women are outliving the men and curtailed immigration will not add enough males to make up the numerical difference between the sexes.' This century has been tough on the lance and fine for distaff. Since 1901 the life expectancy of a girl baby has increased 14 years, of a boy baby only 12½ years. In a long race, handicapping like that insures the winner. Looking backward, we discover that it has been a long fight to keep America masculine. The women might have had us licked most of the time anyhow if we had not been able to call up reserves from Europe. But they began killing their reserves in 1914. Two high spots of masculinity here also came just before wars. The nation was 104.7% he in 1860, and 106% in 1910. But waves of immigration just before those Census years, not wars after them, accounted for the run of the figures. Significantly, 1890 was a peak of masculinity too, 105% male, just as the geographical frontier faded away with the last free land." « » DR. GUY'S "Trauma in the Etiology of Peptic Ulcer" (page 179) was presented in substance at a meeting of the CENTRAL STATES SOCIETY nearly a year ago. That was about the time when the subject of trauma in its possible relation to ulcer began to experience one of those cycles of discussion which now and then embroil medical matters, and which, as to the importance of the one to the other, seems now to be at the high point of general attention. Witness the current frequency of articles and discussions involving the two, among them the "question and answer" treatment at the last meeting of the NEW YORK STATE SOCIETY OF INDUSTRIAL MEDICINE, reported in INDUSTRIAL MEDICINE for February, 1940 (pages 97-100) and the discussion at the meeting of the ASSOCIATION FOR ADVANCEMENT OF INDUSTRIAL MEDICINE AND SURGERY, on February 28, 1940, at New York (see INDUSTRIAL MEDICINE for March, 1940, page 17). DR. GUY'S date of presentation, May 2, 1939, entitles him to leadership in the present interest, even though the text of his very thorough and instructive study is only now appearing. He concludes "that traumatic peptic ulcer does occur, and that we have fairly well established criteria for the recognition of it." « » DR. REYNOLDS has been interested for some time in the matter he presents as "Neurosurgical Aspects of Low Back Pain" (page 182). His article is an important addition to that part of the literature of the subject which belongs in the "quality" bracket. « » DRS. MEADE and MURRAY, to the comparatively few

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—*Continued from page 5.*

cases of true and unquestioned "Traumatic Hernia" now of record, add a case of their own (page 185). And they do it interestingly and convincingly. «» THE "ARCHIVES," this month, yield some pungent words on "industrial medicine" (page 187). In 1930, after "many years of a tolerated existence," it was "coming into its own." Now, 10 years later, it has arrived! «» INDUSTRIAL MEDICINE for July, 1938, had an article, by C. M. MATHESON and M. F. TRICE, describing "North Carolina's Mobile X-Ray Laboratory." Here, on page 188, MR. TRICE describes what that "Laboratory" accomplishes, together with certain other and related activities of the North Carolina Division of Industrial Hygiene. «» AND, following this, on page 193, H. G. DYKTOR discusses the "Integration of Industrial Hygiene with Industrial Medicine." This article should be read and studied *and remembered* by *all* industrial physicians and *all* industrial hygienists, to the end that they may not only meet but also take up their permanent abodes upon the "tremendous amount of common ground upon which they can cooperate to the fullest extent." «» DR. DRINKER announces (page 196) a "Clinical Review in Industrial Medicine" at the Harvard School of Public Health in May. «» DRS. WILSON and CAREY, in their "Gangrene of a Foot," following carbon monoxide poisoning, report an unusual, and very interesting, industrial case. «» DR. CALLAHAN (page 198), and DR. HOBART (page 199), bring a few of the surgical presentations which added so much to the great interest of the November meeting of the CHICAGO SOCIETY OF INDUSTRIAL MEDICINE AND SURGERY. «» THE Fourth Instalment of our Abstracts of the Principal Papers and Discussions at the Fourth Annual Meeting of Air Hygiene Foundation—this one inclusive of two Committee reports—follows on pages 201 and 202. «» THE MICHIGAN SOCIETY OF INDUSTRIAL PHYSICIANS AND SURGEONS announces a meeting on April 17, at Grand Rapids (page 207). «» DR.

—*Continued on page 11.*

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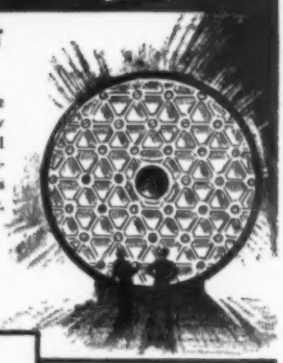

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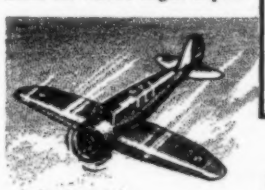

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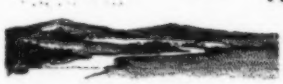

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—*Continued from page 9.*

LINDBERG's "Pneumonia in Industry" (page 203) points out that "pneumonia is a striking industrial health problem." « » DR. FRIEDMAN's conclusion (page 207) regarding the relation of trauma to multiple sclerosis is particularly timely, in this heyday of discussion as to the responsibility of truma for this and that and almost everything. « » FOLLOW then (page 209) the Programs of the *First* Annual Meeting of the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION, and the *Twenty-Fifth Annual* Meeting of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, the first on June 4 and 5, and the second on June 6 and 7, 1940, at New York, and both together constituting a four-day schedule of such interest and value as to make attendance on the part of every one even remotely interested in industrial medicine and hygiene the "meeting must" of the year. « » APROPOS of the book reviews (page 209), the "Medicine" section of *Time*, March 25, 1940, mentions DR. SCUDDER's "Shock" (reviewed here by DR. IVY) as follows: "At Manhattan's Presbyterian Hospital, Dr. John Scudder has tried an extract of the adrenal cortex (eschatin) to save patients already in shock after operations and severe burns. In a newly published text *(Shock)* he reported that cortical extract snatched 14 persons from death after transfusions and oxygen had failed." « » DR.

—*Continued on page 12.*

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—Continued from page 11.

SAPPINGTON (page 210) abstracts two articles from the recent "Industrial Health" issue of *J.A.M.A.* « » AND then comes another of the "question and answer" discussions at the Nineteenth Annual Meeting of the NEW YORK STATE SOCIETY OF INDUSTRIAL MEDICINE, this one on "The Relation of Loss of Motion as Interpreted by Percentage of Schedule Loss." The form and the nature of the similar discussion on "Abdominal Injuries" (INDUSTRIAL MEDICINE for February, 1940, pp. 97-100) aroused considerable interest. This second subject has even broader significance. « » DR. MITCHELL's "Conservatism in Traumatic Surgery" (page 214) is a model of

—Continued on page 218.

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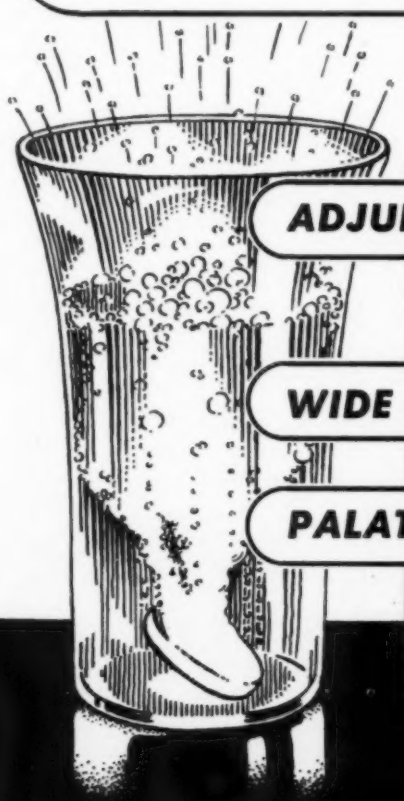

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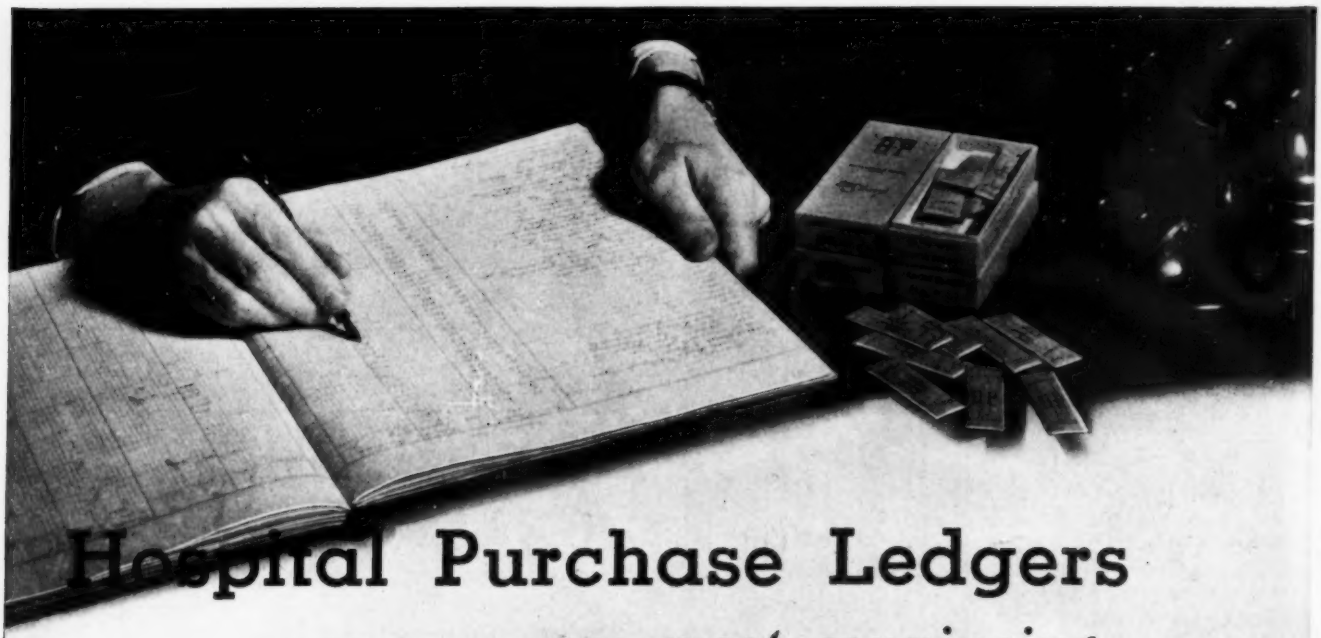

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The Science, the Law and the Economics of Industrial Health

Volume 9 APRIL, 1940 Number 4

Industrial Workers of 1960

—Forecasting the results of the 1940 Census may be foolhardy but, from current trends, it appears that in the population of the United States the percentage of persons past 50 years of age soon may be doubled over the present. At the same time, the percentage below 20 years of age distinctly will diminish. This means the reaching of national maturity and prospective early old age. The shift in population distribution promises many changes in the national life, including the changes in the characteristics of industrial workers. All this represents no coming calamity but instead a national blessing—

CAREY P. MCCORD, M.D.,
Detroit, Michigan

A FEW years hence in this country there may be found twice the present number of persons past 50 years of age. In 1850, about the time of the California Gold Rush, only one person in 10 exceeded the age of 50. The present ratio is one to five and by 1960, under present trends, the number will become one in three. At the same time or earlier, the number of persons below 20 years of age will diminish by more than a third, but less than one-half.

Nations like persons have birth, childhood, maturity and old age. The United States, with respect to population, for a long time has preserved its adolescence, but now, at this very time, is somewhat rapidly passing to maturity. Old age will be reached by 1960 if present trends persist. After that time, barring, unforseen happenings, a declining population will characterize the country. One hundred fifty years from now, the population of this country may be as little as 75,000,000 souls. While this remote date is too far away to engender immediate concern, there are at the beginning of maturity many situations that will shortly affect values of land and improved property, educational activities, types of manufactured products, political pressure groups, choices of professions and characteristics of industrial workers.

This trend, already begun, is reflected in the fact that compared with five years ago, there are now somewhere near 1,800,000 fewer children below 10 years of age, than 15 years ago. This means fewer sales of baby carriages, nursing bottles, safety pins and all of the appurtenances of childhood. Eventually this will mean the need for diminishing school facilities for elementary grades, fewer school teachers, fewer pediatricians, fewer obstetricians, fewer children's hospitals. By 1960 there may arise a diminished labor market of young workers and potential competition within industry for their services. For the time being, the total population will slowly increase so that manufacturing pursuits may be expected to continue on that level compatible with an increasing population. Eventually, the total population will decrease and with it there will arise diminutions in industrial activities. However, before this time is reached, there will have been a period with a comparative dearth of young workers.

A Country of Old People

THE persons who in 1960 and thereabouts will make up the predominating unit in the adult populations are now alive and represent the present high percentage of men and women in their prime, in their child-bearing and child-creating period of life, who, since the turn of the century have been responsible for high birth rates and in some measure the surplus of man power in the early decades of adult life.

This high percentage of men and women between 20 and 50 years of age to a large extent is due to the inpouring of immigrants in large numbers which started about 1850 and which was sharply curtailed about 1924.

As this wave passes into the sixth decade, we face the prospect of a political world controlled through sheer numbers by the old. Already the voice of the old lately has been heard with increasing loudness throughout the land. It does not necessarily follow that these persons will be without work capacity or vitality, although it may be recognized that increased life expectancies at birth

From The Industrial Health Conservancy Laboratories.

largely have been brought about by life conservation in the early decades of life rather than by any deferring of old age. In truth it is expectable that there will be achieved some degree of deferring old age, but the chief reason for large numbers of elderly persons in the country is not prolonged life, but the fact that there are now unusually large numbers of persons who will pass over into higher decades.

Since the numbers of young persons distinctly will be decreased more and more, industry, as it operates today, will find itself more dependent upon elderly workmen, the values in which practice already are becoming apparent. The work span in industry will be increased. The average years of service will be lengthened. If wars arise calling for large armies, the maximum military age will be increased. It is significant that these old persons, making up the then dominant group, and particularly the females, will be past the child-producing period. Notwithstanding, they will influence the lowering of birth rates because of their presence on earth, their need for security, subsistence, need for space and, in general, because of economic and social pressures exerted by them.

Under such conditions, it follows, in the absence of immigration, that oncoming generations will have fewer human units and naturally in the absence of extraneous influences, the total population will wane.

Already we have seen that declining numbers of persons in the youth group will bring about many alterations in the economic pattern of the country.

Equally or more so, increased numbers of old persons will work many changes—more old men's homes, more easy chairs, more spectacles, more false teeth, fewer short coffins, more longer coffins —more geriatrics.

None of the foregoing statements are idle speculations or without practical significance. For example, that well meaning manufacturer who now may be conceiving the laying of the foundation of a stable business for his sons and grandsons in the manufacture of toy horns for children might do well to shun this enterprise, just as the manufacture of buggy whips was to be shunned in 1900. Instead, this manufacturer might do well to turn his capacities to the manufacture of ear trumpets for the aged deaf.

Prospective Population Changes

PRIOR to any further expressions in prophetic vein, it may be well here to furnish a number of authoritative statements, statistical arrangements, record of trends, as evidences of the prospects earlier mentioned and as groundwork for subsequent sections. The changes in population already taking place in the United States and in greater prospect, are not unique for this country, but are shared by other nations and races, each one conforming to a central pattern, but influenced by a great variety of special features. Immigration to the United States, previously mentioned, constitutes the unusual and special feature that upsets normal trends in this country.

Possible Future Increase of Population in the United States (in thousands)

Year	Population January 1	Decennial Increase	
		Numbers	Per cent
1920	105,711	16,825	15.9
1930	122,536	9,964	8.1
1940	132,500	7,300	5.5
1950	139,800	4,100	2.9
1960	143,900	700	0.5
1970	144,600	— 1,700	— 1.2
1980	142,900		

Note the steady diminution in the decennial increase in population until shortly after 1960 there begins actual loss. National old age begins then.

Future Population of States Calculated According to Certain Assumed Trends of Birth Rates, Death Rates, and Migration (in thousands)

Population Without Migration

UNITED STATES

	1930	1940	1950	1960
Under 5	11,454	10,438	10,407	9,626
5-14	24,639	22,245	21,372	20,844
15-19	11,561	12,410	10,489	10,637
20-29	20,720	22,920	23,478	20,718
30-39	18,341	19,849	22,164	22,845
40-49	15,041	17,193	18,826	21,247
50-59	10,628	13,350	15,432	17,094
60-69	6,525	8,355	10,594	12,331
70 plus	3,866	4,920	6,366	8,161
Totals	122,775	131,680	139,126	143,502

It is noteworthy from this chart that between 1930 and 1960 the number of persons expressed in millions from 50-59 years of age increase from 10 to 17. For the ages from 60 to 69, the millions increase from 6 to 12 and for 70 and beyond from 3 to 8.

However, by states, prospective changes are not equalized. Figures indicating the distribution of population by age groupings for four states are now shown:

	Massachusetts			
	1930	1940	1950	1960
Under 5	350	285	276	240
5-14	778	655	578	548
15-19	366	386	297	285
20-29	670	739	728	578
30-39	658	649	721	714
40-49	562	625	624	699
50-59	432	505	568	573
60-69	277	339	400	452
70 plus	157	203	253	303
Total	4,250	4,386	4,445	4,391

	California			
	1930	1940	1950	1960
Under 5	406	348	314	279
5-14	892	804	691	623
15-19	430	458	386	333
20-29	974	831	852	727
30-39	974	936	806	829
40-49	839	918	892	773
50-59	588	750	831	810
60-69	364	468	601	670
70 plus	211	282	367	472
Total	5,677	5,796	5,740	5,515

	Michigan			
	1930	1940	1950	1960
Under 5	464	400	395	363
5-14	943	890	814	790
15-19	417	479	414	402
20-29	834	850	930	808
30-39	789	803	825	907
40-49	610	745	768	795
50-59	393	549	676	703
60-69	243	314	441	544
70 plus	149	183	235	326
Total	4,842	5,213	5,498	5,638

	Georgia			
	1930	1940	1950	1960
Under 5	317	345	355	350
5-14	693	652	714	721
15-19	335	348	327	360
20-29	511	648	647	661
30-39	370	479	616	622
40-49	284	335	442	580
50-59	216	241	290	391
60-69	113	164	184	224
70 plus	68	82	118	140
Total	2,908	3,294	3,694	4,048

The four foregoing tables establish quite clearly within the limitations of statistical methods the marked differences to be expected in different types of states. Georgia, despite its magnificent cities, is to be regarded predominantly as rural. Georgia, while nearly doubling its old age population, will still not suffer a loss, but will make tremendous gain in its youthful population. While Massachusetts in persons under five years of age is dropping from 350,000 to 240,000, Georgia, in that same category, is increasing from 317,000 to 350,000. Such figures as these are of prodigious significance to educators, bankers, merchants, manufacturers and in some measure all other persons in the State of Georgia. Their prospective activities must necessarily have many features peculiar to their own situation and setting them apart from such states as California, where birth rates are at such a low ebb that without a continuous influx of migrants the entire state soon would have committed suicide by the process of non-reproduction.

The key to much that appears in this paper is the birth rate. In order that there may be a table of references around which some later comment may be made, a table of birth rates is now shown:

Past and Assumed Future Birth Rate by Age of Women in Per Cent of Rate in 1929-33*

Year	Rate in % of 1929-33	Year	Rate in % of 1929-33
1795-99	331	1895-99	157
1805-09	331	1905-09	142
1815-19	314	1915-19	135
1825-29	290	1925-29	114
1835-39	277	1929-33	100
1845-49	229	1930-34	98
1855-59	231	1935-39	91
1865-69	207	1940-44	86
1875-79	190	1945-49	82
1885-89	163	1950-54	79
		1955-59	78

* Because of inadequate data regarding differentials in trend of birth rates by five-year age periods of women, it is assumed that rates for all such age periods change at the same place.

Birth Rates

THE first decade of this century was a remarkable one in population increases. If the entire world had kept up its propagation rates as of that decade, for a period of 10,000 years, the population would, according to East, be 221,840,000,000,000,000,000,000,000,000,000,000,000,000,000,000. Allowing only 1½ sq. ft. per person, the above figure would represent 60,570,000,000,000,000,000,000,000,000,000,000 times the standing room on the earth's surface. At this same rate, within the life time of some of our children, this country's population would be equal to that of China today and 100 years hence or thereabouts the population of the United States would approximate two billion souls, which approaches the entire population of the earth today.

Manifestly this will not occur, but it is not equally manifest what will prevent this theoretical rate of procreation. Offsetting theoretical considerations, it must be remembered that on the average and with an overall consideration, only two of the offspring of any pair of animals, however prolific, live to maturity, and in turn become parents. If it may be assumed that for a span of 1,000,000 years man has existed on earth, it may be shown that the net increase for the entire human animal was on the average only about 750 per year up to 1800. This figure is highly speculative and somewhat fantastic, but it serves a useful purpose in pointing out that after the establishment of the new world and the revolutionary war, the world's population jumped from a total of 750 million in 1800 to 1700 million within a period of 100 years (1900) and to more than 2,000,000,000 by 40 years later. This reflects more than anything else the abundance, real and promised, provided by the new world with its then apparently unlimited expanses of land. The philosophy of expansion and optimism dominated the thinking of the Western world and expressed itself in literature, religion, politics, economics and particularly in procreativeness. While the lands of the new world have not proved inexhaustible, and whereas over-population already exists in many portions of it, the new philosophy of expansion forced the land of this country and other countries to lend far more subsistence than it had yielded naturally.

Death rates may not be reduced to the zero point, but birth rates might be controlled to the point of the total decimation of a race. At this time, the trend of birth rates in this country is toward the zero point. Naturally the zero point will not be reached. While falling birth rates greatly disturb militaristic countries, they should cause gladness in a mature land where no good purpose is served by large numbers of surplus persons and where contrariwise the happiness, security, growth and development of a normal population would not be disturbed. It is no credit to a man merely that he sires a large number of sons and daughters. In this respect, man is obviously inferior to rats or flies. Increased population, for population's sake only, redounds, neither to the credit of the individual or the nation. The dis-

credit is in proportion to the difficulties created for these newcomers and particularly the discredit stands in relation to low-qualitied population units. Every unwanted, undesirable child brought into the world keeps out of the world some other child of high potential attainments.

Hooton states: "Modern man is selling his biological birthright for a mess of morons; the voice may be the voice of democracy, but the hands are the hands of apes."

The Old Industrial Worker

FOR many years, the idea prevailed that on the average, workers past 45 are a liability to industry. However, during the present period, dominated by the young, the pendulum has swung so that within the past three or four years widespread publicity has been given to the relative superiority of the comparatively old workman. Scores of publications have been made, including one brochure prepared by the National Association of Manufacturers, entitled "Workers Over Forty," and based on a survey involving 2,485 questionnaires. This report and others like it reach the same conclusion, that the supposed superiority of the young worker is a myth. Among other findings in this survey are the following:

Sixty per cent of the companies do not give preference to applicants below 40 years of age when new workers are hired.

With respect to the frequency of illness, 83% of employers reporting indicate that sickness rates are less or at least not higher in the case of the older worker.

Eighty-four per cent report that the old worker's efficiency is the same or higher than for young workers.

Eighty-one per cent of these employers lay low the old bugaboo of accident risks being greater for the older employee.

In connection with the problems of adjustment to the job, 66% of the employers recorded the same degree or greater aptitude of the older worker over the younger one.

Notwithstanding these favorable attitudes, it may be observed that in this same report, covering 1,656,565 employees, only 4% were over 59 years of age, only 9.8% were between 50 and 59 and 20% were between 40 and 49. More than 38% of industrial workers as employed in 1937 were below 30 years of age.

While it does not appear that the numbers and percentages of old workers in industry are at this time high, it seems clearly established with obvious exceptions that the older worker is capable of carrying out industrial work, is cooperative, is able to adjust, is not accident prone, retains his efficiency and profits by his previous years of experience. It is manifest, at the present time, that the chief factor in increasing ages of workers in industry is the seniority system representing an outgrowth of union endeavor. With or without unions and seniority systems, older workers more and more for several decades to come, will be found in industry. It is conceivable that automatic processes in industry will offset the need for the introduction of large numbers of young workers and apprentices, but if this not be true, the time will come when there may be keen competition for young workers, since the total number available will be curtailed. During recent years the flux in employment has peaked in very young workers, between 20 and 24 years of age. This statement applies to numbers laid off, who resigned, or who were discharged. To some extent, this statement stands in relation to the seniority, but also to an extent to the instability of youth. It is probably true that in coming years the flux in employment still will peak in the early years of life, but for a new reason, namely in the labor market for young workers, there will be such competition as to favor frequent turnover as better opportunities arise. Obviously this will operate to the advantage of the stable elderly worker in so far as he is able to perform the duties theretofore associated with the vigor of youth. It is to be observed that in the prospective redistribution of the population of the country, the percentage, but not the numbers, of persons between 20 and 49 years of age will remain substantially as at present. Much of the net loss will be in the ages below 20 and correspondingly the gain will be in the decades past 50.

The Causes of Lowered Birth Rates

AMONG other agencies that press birth rates downward are the following: The spread of knowledge of birth control and the condonement of its application; increased ages at which marriages take place; unwillingness to bring into the world children when the prospects of subsistence and security are waning; increased sterility, chiefly among women; emotional unwillingness to beget, bear and rear children; a desire that a few children may be generously equipped rather than that a large number may be only moderately cared for. Many other reasons bearing upon this problem might be grouped in social, economic, medical and psychological categories. The final result of the operation of all is that in this country the state of mind and body is such that families are small, birth rates are low and waning, the population is decreasing within the brackets of childhood, and eventually the total population will decrease. This is not a catastrophe, but a blessing.

Are These Changes Inevitable?

ALL statistical arrangements based on trends assume that the forecasts made will not be upset by alterations or terminations of governing trends. Although some of the features connected with the stabilization of a population are already in operation in this country, it must be recognized by all, that complete upsets might arise turning every consideration of demographers to naught. If this country were invaded and possessed by Japan, with its diametrically opposed concepts of population, then it is conceivable that if the people of this country embraced the tenets of Japan, we might find ourselves in this country doubling

our population every 29 years, as we have on the average in the past, from the time of the first census in 1790. If for political reasons this country assumed the role of a militaristic power, the mothers of this country might be called upon to exercise an increased fecundity to the end that more and more soldiers might be provided to compete with soldiers of other nations. It is conceivable that some religion might so capture the imagination of the people of this land as to embody high birth rates as a religious duty. While a diminishing population is predominantly good and sound, political philosophy and action may lead to the lifting of immigration barriers. In that case, much of the significance of this portrayal of trends will be lost. Even though immigration from Europe be deemed desirable, it is possible that this may not readily be accomplished, since the populations of other countries, particularly the more highly regarded countries of Europe, will also be on the wane as noted in the case of England and Wales in a subsequent section.

By every sign, omen, calculation and past experience, this country is destined to become a land of fewer children and more old people, and eventually, after a few years, a land with a rapidly decreasing population and remotely the extinction of the civilization that now characterizes life here.

Further Causes, Consequences and Implications

IN THE United States, about the year 1960, and thereafter, there will be each year some 160,000 fewer brides and grooms walking up to the altar than in 1955. This means that in those years there may be 80,000 fewer homes established and thus this number fewer sources of offspring, regardless of what the national birth rate at that time may be.

The rapid decline in the rate of population growth is foremostly a phenomenon of Western civilization. Oriental populations, although precise statistics are less available, indicate no disposition to fall in with the pattern of the Western world. This at once may be interpreted to mean that population increases are by no means dependent upon the abundance of food, security, etc., but instead an artificial situation based on unwillingness of more and more persons to have large families. At all recent and present times, proper significance must be attached to birth control measures now being approved politically, medically, religiously and socially in many countries.

Best evidence indicates that in 1880 the death rate was about 19.8 per thousand of population and the birth rate about 35 per thousand. The present death rate for the country as a whole now lies between 11 and 12 per thousand, while the birth rate is now about 17 per thousand. This net gain of 5 persons per year per thousand would imply a prospective marked increase in population. This situation, while true, is quite artificial, since by chance, and largely as a result of immigration, a high percentage of our present population is within the child bearing age. This large group is already passing into the age of non-child productivity and the oncoming generation in the absence of the impetus of immigration will unfailingly not maintain recent birth levels. At least this is true in the absence of unexpected influences that will result in increased birth rates.

In a stabilized population in this country, the birth and death rates will be leveled off at about 13 or 14 each of births and deaths per year. So recently as 1900, 170 out of every thousand children born died before the end of the first year of life. Now this number is about 50.

It now becomes apparent that in the past nearly all families have had more children than were wanted. In the absence of knowledge of birth control, unwanted and accidental pregnancies have dominated the situation. In the future, it will not be possible nor is it desirable to rely upon unwanted babies for increases in population.

The present excess of 800,000 births annually over deaths, which we now enjoy, or of which it possibly should be said that we now condone, will soon disappear and not because of any lack of potential fertility, but because of growing distaste for the acceptation of the burdens of marriage, pregnancy and child rearing.

The present population of the world is estimated to be about 2 billion and 70 million. Present increases in population are still greater in the Americas, where the increase rate is about 1.5%, per annum. In Asia, the increase rate is only about 0.5% annually. No less, it is still tenable to maintain that marked decrease in population of the United States is inevitable. Although the population is increasing, the present generation is not reproducing itself.

The higher the income, the greater the skill required in occupation, the smaller is the size of the family under the conditions of present trends.

The impoverished rural states have been and will continue to be the population reservoir for the country.

In the Carolinas, twice as many children are born per family as is true for California, but in California three times as much money is spent per child in elementary school education.

A desirable population for any country is that number of people conducive to the best interests of the inhabitants of that land. Judged by that test, there are few countries on earth that already are not over-populated. This statement applies to the United States, taken as a whole, although there are certain sections of the country not yet over-populated. A waning population in this country is under way despite the fact that it is the richest country of the globe, it is richer than all European countries combined, and the sum of the income of this country's people approximates half the world's income.

In the Southern states, already there are perhaps more than 6,000,000 people in excess of that number desirable for the best interests of that section. Notwithstanding, the prospects of an increasing population for the Southern states are in evidence. This statement stands in relation to the fact that farming countries far outstrip urban areas in racial fertility. No optimistic stand may

be taken in the long run for any great and sustained prosperity for the Southern states of this country, taken as a whole. The greatest single step that Southern states might take at this time is effective action designed to curtail its future birth-rates.

The much praised achievements of medical and public health professions chiefly have resulted in the survival of the unfit. In saving the lives of the weak, we are undermining the physical well being of future generations. At this time, there are 10 persons in institutions for mental diseases where there was one in 1880. This is true, although it is believed that at this time only one person is in such institutions for every 10 that should be institutionalized. However, it must be observed that these figures stand in relation both to facilities for the care of mentally diseased persons as well as to their numbers. Every action on the part of benevolent agencies, including governmental agencies in behalf of the weak, the dull and the mentally defective, is detrimental to the vigor, sturdiness and productiveness of desirable types. The use of the term "under-privileged" to designate these undesirables in no sense banishes the probability that we are facing a world of the unfit, for the unfit and by the unfit. No large scale measure operating in this country at this time promises other than the marked increase in the unfit of the land.

If at the time of the establishment of the Republic of the United States, an impenetrable barrier against immigration had been created, the present population of this country would be about the same as at the present time. The quality would have been much higher, although it may be granted that some of the countries of Europe use the colonies as a dumping ground for its undesirables and particularly its criminal element.

Prior to 1850, the "well-to-do" in this country by presumption, and in England by more nearly established fact, produced the large families. The "well-to-do" formerly married earlier than the man without property. Apprentices seldom assayed marriage until they attained some degree of security. Slowly this practice declined as the opportunity for leaning on public agencies increased. The present situation is such that the "well-to-do" must curtail its family size or avoid marriage in order to meet taxation problems necessary to care for the "ne'er-do-wells" of the land, who with much less restraint will go about the business of procreation. The intelligent and "well-to-do" minority of the United States is being crushed down by the burdens imposed by the ever increasing percentages, but not necessarily numbers, of those persons of such inferiority that they must lean upon public agencies for the necessities of life and whatever luxuries they may have. If proof be needed, it may be shown statistically that laboring groups in the unskilled class are presenting 15% more children than are necessary for family replacement while skilled and professional groups are providing only 75% of that number of children needed to reproduce their kind. The lowest intelligence scores come from families averaging six children. Feeble-mindedness is far more prevalent in families averaging 5½ children. Children of superior and very superior intelligence come from families averaging less than 2.5 children. The implications in this situation are self-evident.

Food is more abundant on the farm than in any other national group, next abundant among people living in cities and least abundant in small towns. This fact stands in some relation to the fertility of the farm population, but decidedly this is not the dominant factor.

This country does not stand alone in its prospect of diminishing population. England and Wales in 1940 has an estimated population of 40,655,000. If present trends continue, and eventuate in fact, 40 years hence the population of England and Wales will be 28,857,000. One hundred years from now the population of England and Wales under present trends will be less than 5 million.

What Should be Our Attitude?

THE philosophy of expansion, growth, multiplication, increasing city limits, pyramiding real estate values is over, on an overall scale, as far as may be predicated upon any belief of unlimited population growth. Like the upward swelling of the stock market curves from 1923 to 1929, it has been assumed that upswinging curves of population would go on and on. What happened to stock markets in 1929 will happen to the population, but at a lesser tempo. Already the numerical population of the United States desirable for its good has been reached. In view of the quality of the population of this country, further increases in population are undesirable. Instead of alarm, rejoicing should dominate the attitude of the constructive elements among the people of the land. With the disappearance of the harrassing need for increasing numbers of schools and school teachers, more attention may be paid to the individual. Quantity should give way to quality. Birth limiting attitudes and measures here regarded in their best sense which already have reached the superior families of the land should with increasing impact be brought into the lives of the inferior and unfit. Public agencies of every description should be made to realize the destructive forces being created in the multiplication and coddling of the unfit under any circumstances and particularly at the expense of those persons living and potential. who may be expected better to contribute to the solution of the total problems of the country. We now even face a government of the unfit, by the unfit and for the unfit. Such a government cannot survive.

In the realm of industry, the problem of the supply of workers will not be great. Payrolls in truth will include increasing numbers of older workers, but it appears to have been demonstrated that these older workers are in most instances capable of carrying on industry's work. Personnel and health problems characteristically will be those of the older worker. If an actual shortage of

labor developed, opportunities for mechanical operations are already such that this need may be offset by automatic processes.

On the other hand, industry will be faced with more significant situations as to what to manufacture, altered markets, changed values in property. Conservatism is to be expected from an old age population, notwithstanding which industry will in some likelihood be required to face increased expenditures for old age security, pensions, insurance, the cost of institutions for old age care, etc.

Finally appraised, a preview of the decades between 1940 and 1980 solely with regard to population prompts the belief that they will be more good than evil, more helpful than harmful, that the demand should be for a better quality of humans rather than large numbers of them. For all of this prospect we should rejoice, but there are problems ahead.

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Southern Railway Surgeons

THE Forty-Third Annual Meeting of the Association of Surgeons of the Southern Railway System will be held at Charleston, South Carolina, June 4, 5, and 6, 1940. Dr. F. Webb Griffith, of Asheville, North Carolina, is the President of this organization, and the officers and the Program Committee are arranging a program of unusual interest and value.

Trauma in the Etiology of Peptic Ulcer

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THE average physician rarely has occasion to express an opinion as to whether external violence was a factor in the production of a peptic ulcer in a given case. But those who deal frequently with medicolegal, compensation, accident or insurance cases occasionally have this question to consider; and it includes the relation of trauma not only to acute and chronic new ulcers but to the aggravation and complications of preexisting ulcers.

A search of the European medical literature in recent years reveals many references to this subject.

Our American periodicals contain surprisingly few when one considers its medicolegal significance. Gerendasy[1] in 1933, Eusterman and Mayo,[2] and Gray[3] in 1934, and Kellogg[4] in 1939 have made the four most noteworthy contributions. Kellogg's article is comprehensive and appeared in the *Review of Gastroenterology* in the first two issues of 1939. It is recommended to anyone wishing to read a thorough review of opinions expressed by many authors on this question.

In general it may be said that the existence of true traumatic peptic ulcer was doubted for years and is still doubted by some; but that the four authors mentioned, as well as most of the recent European contributors, now admit that traumatic ulcer may and does occur, and that it is of increasing medicolegal significance.

My purpose is not to review a long series of case histories, but to summarize the present status of this subject in its phases which bear particularly on the medicolegal aspect. This will involve a consideration of acute and chronic ulcers and of ulcer complications; and some observations of a few recent court decisions.

ACUTE peptic ulcers, practically all will agree, are generally the result of two processes; first, a devitalization of an area of mucous membrane, and secondly, necrosis or digestion of this area by gastric juice. There is also general agreement that devitalization may result from direct violence such as an epigastric blow. Numerous case records and animal experimentation support the conclusion that direct violence may tear or rupture portions of the gastric or duodenal mucous membrane or produce a submucosal hematoma which later is followed by ulceration. The mechanism is probably a compression of the hollow organ against the spine and such an injury to the stomach is particularly apt to occur and involve the lesser curvature if the stomach is filled with food or gas at the time. Dr. Frost and I discussed the mechanics of such traumatic lesions in an article[5]

Read before the Annual Scientific Meeting of Central States Society of Industrial Medicine & Surgery, May 2, 1939, Rockford, Illinois.

which appeared in the *American Journal of Surgery* two years ago. Vomiting of blood shortly after epigastric trauma occurs not infrequently and must be interpreted as due to some tear in the mucosa of the upper gastro-intestinal tract. In the great majority of cases such tears heal promptly, unless of course there is actual perforation of the bowel wall. They heal readily in experimental animals after deliberate trauma, and this observation is one advanced to disprove the theory that ulcers may be due to trauma. But enough unquestionable cases have now been recorded to support the opinion that occasionally the tear does not heal promptly and an acute peptic ulcer results. One good example is Eusterman and Mayo's case of a 16 year old boy who developed typical ulcer symptoms after an epigastric injury, and had an ulcer which was visualized by x-ray. These acute ulcers generally heal with medical management in a comparatively short time. Those who oppose the traumatic theory claim that "silent" or symptomless ulcers may exist, and that the trauma aggravates or calls attention to an ulcer which was previously unrecognized by the patient. This would seem to be going beyond the limits of probability in some cases. Certainly the pathogenesis does not change simply because in one patient the trauma is compensable and in another it is not. For these reasons the opinion is steadily increasing that epigastric trauma may cause acute gastric or duodenal ulceration. To establish that it has done so we may reasonably demand three points of evidence: First, hemorrhage, either in the vomitus or the stools, within a few hours or days following the injury, is to be expected. Rather convincing cases of alleged traumatic ulcer are on record in which no known hemorrhage ever occurred. But it would seem that, at least in the majority, trauma sufficient to rupture the mucosa should be manifested by some signs of hemorrhage into the lumen of the stomach or bowel. For the same reasons, a period of shock or disability is to be expected together with external evidence of bruising of the abdominal wall. Second, symptoms such as typical ulcer type of pain should appear within a few weeks. Several authors record the pain of traumatic acute ulcer as being severe and constant in the early stages, later developing into the more classical intermittent type of gnawing pain relieved by eating and alkalies. Third, the absence of previous gastro-intestinal disorders should be established. The latter point is often of little value, as we generally have to take the claimant's word that he was previously well, unless there is definite evidence to the contrary. It is therefore advisable to inquire as to any previous digestive disorders in every patient examined because of recent abdominal injury.

If in addition an ulcer can be demonstrated by x-ray or gastroscopic examinations, the chain of evidence is complete, and we must conclude that trauma was the exciting cause. Use of the word "exciting" suggests the various other factors that may be of importance in the development of peptic ulcer, but there is nothing to be gained in this discussion by a review of all of these. Perhaps the injured employee does have badly infected teeth and is the heavy-smoking, highly emotional, apprehensive type who lives on an irritating, poorly balanced diet. These factors need attention in the treatment of his ulcer, and possibly are of importance in its cause, but the evidence still indicates that he had no ulcer before the accident and following it he did have one.

Two questions may now be asked. First, what percentage of peptic ulcers have a traumatic basis or history? The most convincing statistics[6,7,8] indicate that about 1% to 2% are probably related to trauma. And second, may traumatic ulcers develop following injuries such as a fall which may tear the bowel or gastric wall in the absence of direct injury to the epigastrium? Theoretically this is possible as complete ruptures of the intestines are known to occur in this way. But these are great rarities, and we can insist that a definite epigastric injury must be proved before considering a peptic ulcer as of traumatic origin. The well known ulcers which follow severe burns do not enter into this discussion; neither do the cases of ulcer which follow swallowing of a foreign body.

IF THIS is all true about the acute ulcer, then what may we say about the chronic one? If the physician can observe the patient over a period of several months following the injury and can note the symptoms of an acute ulcer, such as has been described, persist and become chronic, then he should have little doubt as to the etiology. With proper treatment and a cooperative patient this rarely happens, as traumatic ulcers heal readily as a rule. Where the largest room for argument is found is in the case of an employee who presents the typical ulcer picture and who attributes it to an injury several months earlier. Two questions then arise. First, can trauma produce a chronic peptic ulcer? It seems that we must answer this in the affirmative. It is logical to assume that all chronic ulcers, regardless of their cause, type or location, are acute ones at the start. Why some acute ulcers heal and others do not cannot be satisfactorily answered in the present state of our knowledge of this disease. So it would seem that we must conclude that if trauma can cause acute ulcers, then a certain percentage, admittedly small, of the acute ones will persist and become chronic. This is difficult to prove conclusively and some authors[9] hold that no convincing case has ever been recorded. They would prefer to believe that the trauma merely aggravated a previously silent or unrecognized ulcer. The second question then to be answered is: Did the particular ulcer in the case of our employee result from trauma? And here we may go back to the chain of evidence asked for in the case of the acute ulcer. If the employee did not report the original accident, if it did not incapacitate him, if there were no evidences of external injury or of hemorrhage from the stomach, and if he did not develop ulcer symptoms within a reasonable time afterwards, then

his claim is not supported by the evidence, especially if there is reason to believe there was some pre-existing gastro-intestinal disorder. But when this chain of evidence is reasonably well proved and the chronic ulcer is reasonably well demonstrated by the typical symptoms and the laboratory and x-ray findings, then in all fairness to him we should stop quibbling about the etiology, and handle his case as one of disability due to injury.

One other type of ulcer case deserves mention in passing. Occasionally we see symptoms of peptic ulcer develop in a patient debilitated by some serious injury or illness unrelated to the gastro-intestinal tract. I know of one such patient who suffered a fractured spine and developed a typical peptic ulcer during a long and stormy convalescence. He never claimed an epigastric injury, but blamed the ulcer on worry, fear, pain, incarceration in a body cast, etc. Needless to say, such ulcers should not be construed as of traumatic origin.

And now we may consider the effects of trauma on a pre-existing ulcer. Many litigants have claimed that an ulcer of long duration has been quiescent, and almost or completely symptomless, for years until trauma has activated it. The answer to this question can be given by many patients with chronic peptic ulcers who will report that bending exercises involving contraction of the abdominal muscles aggravate their ulcer symptoms. Alvarez[10] called attention to this three years ago and stated that it was often hard enough for a man with an ulcer to stay well when he could sit at a desk all day, and one wonders how a laborer with the disease ever gets well. He emphasized that severe exertion or contraction of the abdominal muscles can produce hematemesis in patients with peptic ulcer, and reported a typical example. If exertion can make an ulcer bleed it must have aggravated it. And if exertion can do this, certainly epigastric violence may do so. And if aggravation occurs, when will it stop? It obviously may lead to severe, even fatal hemorrhage, or to perforation, the two greatest dangers of peptic ulcer. There is almost unanimity of opinion of all authors on the subject that external violence can and frequently does aggravate pre-existing or quiescent peptic ulcer.

All this may be disagreeable and disquieting to insurance carriers and the employer representatives. What is more, the increasing frequency of automobile accidents may make the traumatic ulcer question assume steadily increasing importance. Eight years ago Kessler,[11] in his textbook on accidental injuries quoted Liniger and Molineus as having advanced four postulates that must be satisfied before a valid claim to traumatic peptic ulcer can be established. These were:

"1. The patient must prove the absence of gastric disease previous to the accident." This is an unreasonable request as we know that often the only final proof of an ulcer is visualization at x-ray, operation or autopsy. To carry out this postulate we would have to make the ridiculous demand that the claimant produce x-ray evidence that his stomach was normal before the accident.

2. "Trauma must be severe and localized to the epigastrium;"

3. "Symptoms must follow the injury immediately." Immediately certainly should include the first 24 to 48 hours.

4. "A continuation of symptoms or signs pointing to a gastric or duodenal ulcer."

These last three postulates are reasonable, and they may be taken at the present time as the essential basis on which an ethical answer to this question may be given in any particular case, whether it be one of a new ulcer or of aggravation of an old lesion.

WITH this summary of the situation as a background it is of interest to review some court decisions. As is to be expected, these are frequently contradictory and as far as I can determine no precedents of great importance have been established in this country. Kessler reports that the German State Insurance office went on record in 1927 as denying any relation between trauma and gastric ulcer. I could not learn whether this opinion still prevails. The Supreme Court of Nebraska[12] in 1922 used this language in deciding a case involving a luetic skin ulcer which followed trauma: ". . . the evidence does not suggest any cause for the existence of the ulcer at the precise place of injury and so soon thereafter, other than the accident which occurred in the course of the employment. While it is true that the disease caused the wound to ulcerate, the evidence is most persuasive that without the wound there would have been no ulceration." Such an argument is hard to refute in a case of proved peptic ulcer soon after an epigastric injury in the absence of any prior evidence of the disease. Gerendasy in 1933 records the case of a woman, aged 44, who suffered an epigastric bruise and developed typical ulcer symptoms with x-ray evidence of ulcer two weeks and also three months after the injury. The New Jersey Supreme Court decided the case in favor of the plaintiff.

A case in which I was called to testify a few years ago in Chicago clearly illustrates that the final court decision must rest on the weight of medical evidence presented. A 59 year old male had a history of some mild gastro-intestinal disorder and a heart lesion in November, and received medical attention. No definite diagnosis of peptic ulcer was made. While at work for a dairy company the following May, he was kicked in the right lower quadrant of the abdomen by a horse. He was incapacitated for several months and his cardiac condition grew worse. He then improved somewhat and returned to light work in October. At no time was there any vomiting of blood or definite ulcer complaints. Two months later he became acutely ill and an emergency laparotomy revealed a perforated ulcer. He died of peritonitis and I performed an autopsy which revealed three chronic pyloric ulcers, one of which had perforated. His widow brought the case before the Industrial Commission[13] where I testified that his death was not related to the accident.

Other members of our profession testified to the contrary. The arbitrator entered a reward in favor of the widow on the theory that death was due to the kick of a horse. The Commissioners on appeal reversed this decision and the Superior Court upheld the reversal. Thus no award was ultimately allowed.

It would serve no useful purpose to cite other court decisions, but we may conclude that the burden of proof rests on the physician who assumes that a certain ulcer is the result of a certain trauma. We also may conclude that traumatic peptic ulcer does occur, and that we have fairly well established criteria for the recognition of it.

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Neurosurgical Aspects of Low Back Pain

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THE majority of painful low back conditions are successfully treated by conservative means. There remain, however, a few cases that do not respond to these measures, and this small group of cases constitutes the so-called "low back problem." The literature dealing with this problem is enormous and the various types of treatment that have been recommended embrace everything from rest to radical surgery.

A portion of the cases that do not respond to conservative treatment are patients who have a herniation of the nucleus pulposus with nerve pressure. General recognition of this condition is very recent. To be sure, herniation of the nucleus pulposus into the body of the vertebrae has long been known to occur, and although this condition has been described, no particular significance has been attached to it. Then, too, neurosurgeons have repeatedly reported removal of extradural tumors, usually classed as chondroma, which were in reality protrusions of the nucleus pulposus. It was not until Dandy[1] in 1929 reported the removal of two such tumors which were diagnosed as herniation of the nucleus pulposus, that this condition was brought to light. Following the work of Mixter and Barr,[2] Massachusetts General Hospital, who were among the first to describe the pathology, method of demonstration and operative results, this condition began to be widely known. With the establishment of herniation of the nucleus pulposus as a definite clinical entity the low back problem became one of active interest to the neurosurgeons.

All cases of intractable low back pain with sciatic radiation are not cases of posterior protrusion of the nucleus pulposus, but it is my feeling that all cases of low back pain with sciatic radiation that do not respond to conservative means in a reasonable period of time should be considered cases of protrusion of the nucleus pulposus until proven otherwise.

THE clinical picture presented by herniation of the nucleus pulposus with nerve pressure is, of course, varied. Pain is the most constant feature and in our series besides low back pain there was also sciatic radiation of pain, usually in only one leg. This radiation is over the course of the sciatic nerve and frequently extends into the heel. Numbness of the lateral aspect of the leg is also a rather constant finding and a few of these cases have well defined sensory levels. All of the long standing cases had demonstrable atrophy in the affected leg with loss of muscle tone and absence of the ankle jerk. In a few there was also a loss of the knee kick. Although different workers have reported protrusion of the nuclei so large as to cause a spinal block similar to that found with spinal cord tumor, we have not seen any cases of this magnitude.

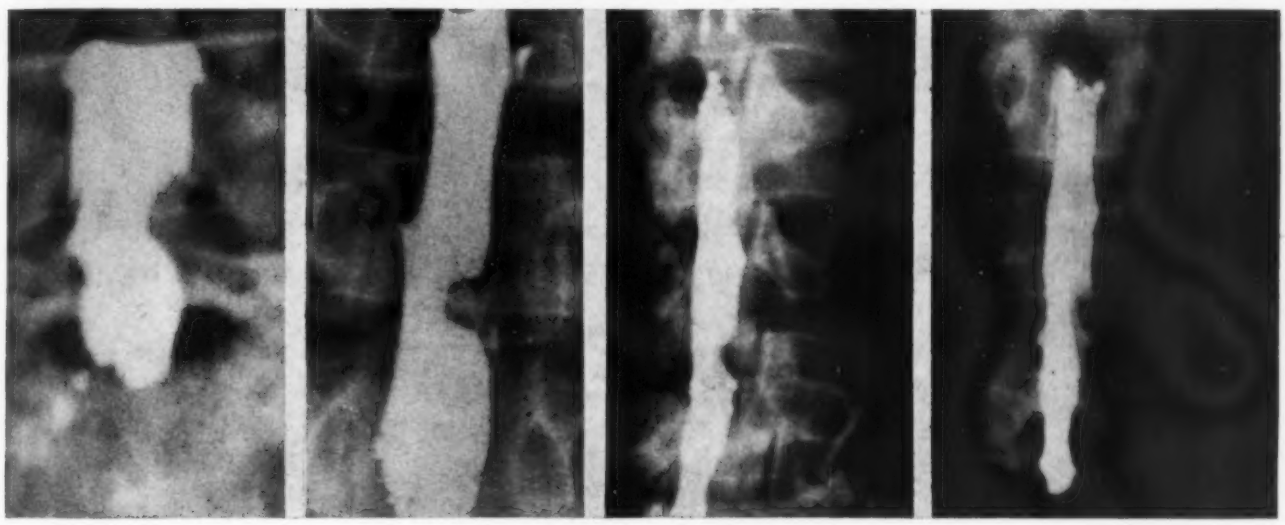
Some workers have reported cases of protrusion of the nucleus pulposus which did not reveal any signs or symptoms in the extremities, merely intractable low back pain. So far, we have not experienced any such case; in fact, we have not attempted a spinal lipiodol injection in the absence of findings in the extremities. All the cases in our series had a definite history of injury of an effort strain type, and usually the patient was able to describe a definite snap or popping in his back which was immediately followed by pain in the back and in the leg. Occasionally the leg pain did not develop for several days after the injury. We have not seen any cases associated with trauma of the direct type nor associated with fractures.

The cases of prolonged back pain with sciatic radiation complaining of numbness and weakness of the leg, together with the physical findings of partial anesthesia of the leg, weakness and loss of tone with sluggish or inactive reflexes on the affected side suggest the possibility of protrusion of

the nucleus pulposus. However, we wish to point out that many early cases of low back injuries have the identical symptoms but lack the physical findings of sensory and reflex changes, and that these cases respond to conservative treatment. These cases, therefore, are not protrusion of the nucleus pulposus. The distinguishing features between the two conditions are sensory and reflex changes and the element of time—one will rapidly clear up while the other will persist. It is for that reason that we always speak of intractable low back pain when discussing lesions of the nucleus pulposus.

When the history and physical findings are such as to suggest the presence of a herniation of the nucleus pulposus, a spinal puncture should be done and spinal fluid total protein determination made, along with other routine spinal fluid examinations. A total protein reading of 45 milligrams percent or above suggests the presence of a nucleus pulposus. However, this should by no means be used as a positive guide as the suspected case should always have a spinal lipiodol injection regardless of protein reading. Occasionally the ordinary x-ray will show some narrowing of the intervertebral disc which gives a lead, and also jugular compression at times will reproduce the pain in the back and in the leg. We have not had any constant findings with this test. The final word in the diagnosis of the nucleus pulposus rupture is spinal lipiodol examination. A laminectomy should never be attempted unless there are positive findings to the lipiodol picture. The defects revealed in an adequate lipiodol examination, as a rule, are constant and quite conclusive.

WE wish to offer a word of caution in the use of lipiodol. We do not at all recommend its indiscriminate use, as we have run into grief on several occasions in handling compensation cases in which the pain was greatly aggravated following the lipiodol injection and remained of a disabling nature in a few cases for a number of months. Fortunately these experiences have not been frequent. However, the majority of cases received some reaction following the lipiodol injection. This reaction usually comes on about 24 hours from the time of the injection and consists of a slight increase in the amount of pain with increased radiation of pain, slight elevation of temperature, headache, and occasionally nausea and vomiting, and stiff neck. This type of reaction usually lasts about 48 to 72 hours and then subsides. Undoubtedly, this is a mainfestation of a low grade chemical meningitis. Of course, in those patients who



Lipiodol Defects

Fig. 1: Case I **Fig. 2: Case II** **Fig. 3: Case III** **Fig. 4: Case III**

are followed with a laminectomy with opening of the dura as much lipiodol as possible is removed at the time of operation. But in many of these cases, the operation is extradural and the lipiodol in those cases remains permanently.

I would like to say also that there have been a few cases who were relieved of their low back pain following the administration of lipiodol. I cannot understand this, and make no effort to explain it. One such patient had suffered from low back pain for a period of 20 years. Spinal lipiodol examination revealed a well defined defect and when we went to talk to the patient in regard to operation he stated that he was completely free of

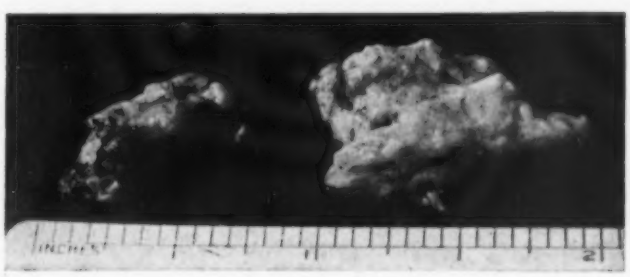


Fig. 5. Tumor removed from Case I

pain, and check-up two years later revealed that he had not had any recurrence.

When the diagnosis of herniation of the nucleus pulposus has been established the treatment, of course, is laminectomy with removal of the tumor. If these lesions are in the lower lumbar region

(4th or 5th lumbar) they can frequently be removed with a unilateral laminectomy and extradurally. As the majority of them are on one side or the other and the protrusion is encroaching upon one of the nerve roots, we have not seen any protrusion in the mid line in the lower lumbar spine which had caused any symptoms. However, removal of the nucleus in the spine elsewhere usually requires a transdural approach, although we have not seen any cases involving the dorsal or cervical spine, the highest lesions in our series being the second lumbar. Following removal of the herniated portion of the nucleus the wound is closed with no attempt made to perform a spinal fusion.

Fig. 6. Tumor removed from Case IV

THE statement that the surgical removal is the only treatment for this lesion is not quite correct. We have had two cases in our series who have recovered and have returned to active work without operation. The histories of these two cases are extremely interesting, and the explanation would seem to concur with the observations reported by a number of workers that with manipulation the herniated portion of the nucleus would work in and out. Check-up two years later found both these cases without recurrence.

There has been considerable discussion in regard to hypertrophy of the ligamentum flavum as a cause of low back pain and sciatica. We have constantly been skeptical that this could cause any symptoms and have found only one case in which there was a definite hypertrophy of the ligament. This was removed and failed to give satisfactory relief. The patient was then re-explored and it was found that we had missed the herniated nucleus. It is therefore our feeling that hypertrophy of the ligamentum flavum alone is of no particular importance in producing symptoms, and when present is always associated with a rupture of the nucleus pulposus.

SUMMARY: A very small percentage of cases of low back pain fail to respond to conservative treatment. A few of these cases who fail to respond are cases of rupture of the nucleus pulposus with posterior protrusion of the nuclear contents. The clinical picture presented is one of intractable low back pain with sciatic radiation in which there is found anesthesia of the affected leg, weakness and atrophy, with diminished reflexes on the affected side. Diagnosis is confirmed with spinal lipiodol injection and the cure is surgical removal of the protruded portion of the disc. We are not impressed that hypertrophy of the ligamentum flavum is an important factor. We feel that indiscriminate use of lipiodol is not advisable but do not hesitate to use it when a protrusion of the nucleus pulposus is suspected.

Fig. 6. Case IV: Lipiodol Defect

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Traumatic Hernia

William H. Meade, M.D., F.A.C.S.,
and
Sam Murray, M.D.

A TRUE "traumatic hernia" is a rare incident, and in view of the attitude taken by many that they never occur, we believe the report of a case is justified.

A "traumatic hernia" is the result of either a great and sudden increase in the intra-abdominal pressure, or a blow directly at the site of protrusion. The structures at the hernial site are torn or avulsed from their normal anatomical attachments, with either the fascia, muscles and peritoneum or all of the abdominal wall structures losing their anatomical continuity. These hernia have no preformed sacs and are, therefore, direct in type. Associated with a traumatic hernia are edema, ecchymosis, and gross hemorrhage. The symptoms are pain, vomiting, and, in severe cases, prostration, and the appearance of a mass within 24 hours which was not apparent previously. In a review of nine cases found in the literature, the mass was not found in the scrotum.

Unquestionably, this type of hernia is compensable, and furthermore any delay in operating upon the patient occasioned by "insurance red tape" may be costly both to the patient and his employer's carrier.

According to Levy,[1] the term "traumatic hernia" has given way to a more rational expression, "occupational hernia," but we are in agreement with St. Jacques,[2] who believes the word "accidental" should cover all varieties of hernia appearing after any kind of injury, and that the name "traumatic" should be reserved for hernias resulting from direct trauma, such as a blow on the abdomen. The term "effort" hernia should be applied to all other varieties developing under stress of work.

Whereas Fallis[3] obtained a history of trauma in 62.1% of 1600 cases of hernia, he concluded that a preformed sac was essential to the development of the condition, although strain and accidental effort contributes as a precipitating factor. Green[4] is convinced that all hernias are the result of congenital defects and are occupational rather than traumatic. Davis[5] raises the question as to whether dilatation of the inguinal rings and canal occurs slowly as the result of constant exertion with gradual production of a hernia. This question may be answered by the observations of Cosens,[6] who while in charge of a war prison camp, kept the records of the condition of 27,635 men, and believed the explanation given by many that they had to perform manual labor to which they were not accustomed, truthfully explained the causation of their hernia.

Citing the experience of 31 years, Coley *et al*[7] claimed to have never seen a true traumatic hernia. Moorhead[8] was unable to find a single instance of hernia due to trauma, even in crushing abdominal and chest injuries. Moorhead[8] also reviewed 232 cases of hernia, and observed chronic peritonitis in the sac as a constant finding. He concluded that it would require at least a year of irritation to produce such changes in the peritoneum. At a national meeting of the Conference Board of Physicians in Industry,[9] not a single case of traumatic hernia could be recalled other than the one which was presented at the meeting.

As Moorhead[10] and Hirshfield[11] have pointed out, many people who have hernia are unaware of it. The Surgeon-General's office noted an incidence of 4% in the men from ages 21 to 30 in examination of 2,754,000 males, and Hirshfield,[11] in an examination of 833 men, found 23 hernias, or 2.7%. Only four of the 23 with hernias were aware of the fact at the time that the diagnosis was made. Davis[12] has mentioned that many who have hernias are prone to conceal the defect from their families and friends. Furthermore, Moorhead[10] has noted that one examination may be insufficient as the sac may be unoccupied by bowel or omentum, and cannot be induced to descend at the first examination.

From the foregoing it is easy to see that many are skeptical as regards trauma being the initiating factor in the production of any type of hernia, but we are convinced from our own case and from the persual of other cases reported that "trauma" may be the sole cause of abdominal herniation.

When a traumatic hernia is suspected, immediate operation is indicated, for injury to the viscera may be expected. As Chabrut[13] and Novarro[14] have noted, injury may occur to the omentum, the vessels in the mesentery, and also to the bowel wall. Leinati's[15] patient was kicked in the groin by a horse, and operation upon the patient disclosed a laceration of the small intestine and peritonitis.

In 1906 Selby[16] reported a case of unquestioned traumatic hernia. Whereas Mock,[17] in 1919, reported four cases of true traumatic hernia, lately there have appeared in the literature additional instances reported by McWhorter,[18], Ehalt,[19] and Maxeiner.[20] To these cases we add our own.

Case Report

J. T., Negro male farmer, age 58, was admitted to Charity Hospital at 9:02 P.M. on July 5, 1939, complaining of pain in the abdomen.

He stated that on the previous day at 10 A.M. his plow struck a rock, causing the tip of the right handle to jab him in the right side of the abdomen, just over the groin. He was knocked down by the plow, but got up and continued to plow for 30 minutes. He then walked a half mile to his house, where he ate his noon-day meal. One hour after eating he was seized with an agonizing pain in the abdomen, which caused him to double up, and to vomit. He ascribed this episode to having been served "tainted meat" at the meal, but he also noted for the first time a swelling above his right groin. Self administered soda, vinegar and Epsom salts failed to relieve the pain, and he consulted

From 145 W. Mason St., Jackson, Michigan, and the Department of Surgery, Tulane University, and Charity Hospital, New Orleans, Louisiana.

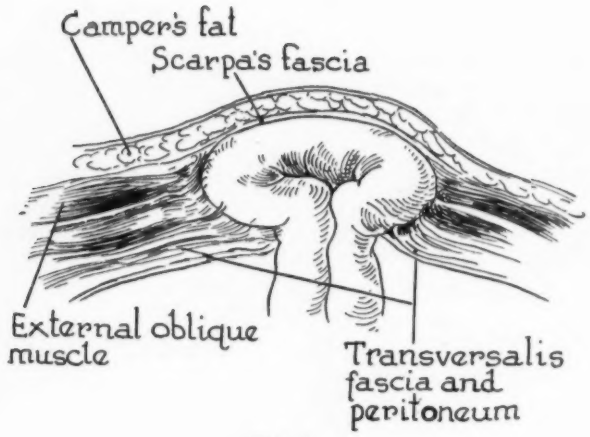

Fig. 1.

his physician who sent him to Charity Hospital with a provisional diganosis of ruptured abdominal viscus.

The patient stated that he had never noticed a swelling above the groin before.

Upon physical examination, the patient was seen to be well developed and adequately nourished. He was not suffering and the abdominal phase of his respiratory function was not diminished. The abdomen was soft and not distended. Peristalsis was normal as determined by auscultation. In the right inguinal region was a mass, approximately 8 x 4 x 3 cm. in size, which bulged noticeably when the patient coughed or strained. It was felt that the mass contained intestine lying directly beneath the integument. The tumefaction was exquisitely tender to palpation. Examination of the opposite inguinal region revealed nothing abnormal, the fascial structures being well developed and normally placed.

The diagnosis of a traumatic interstitial direct inguinal hernia was made, and an immediate herniorrhaphy was decided upon.

Under spinal analgesia of 150 mg. of novocain, an incision was made parallel to and approxi-

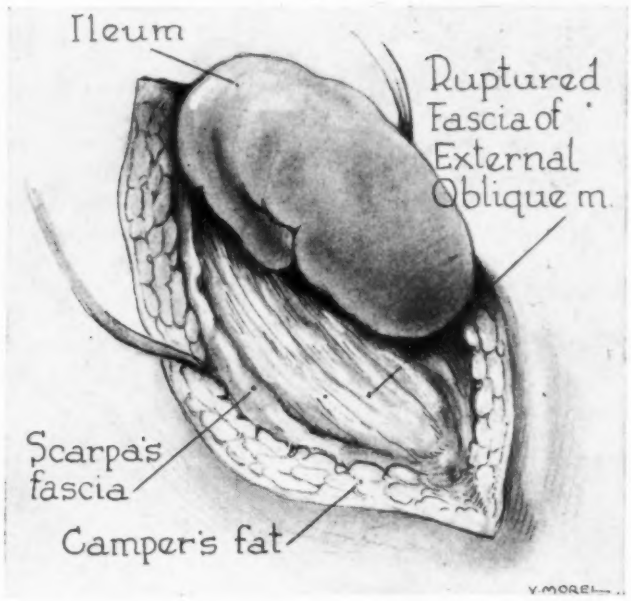

Fig. 2.

mately 4 cm. above Poupart's ligament. As was suspected, the intestines lay directly beneath the skin, but it was noticed that no sac was present (Figs. 1 and 2). Approximately 150 cc. of serosanguinous fluid escaped from the wound. The conjoined tendon was found to be ruptured close to its insertion (Fig. 3) and the fibers of the internal oblique muscle and the transversalis fascia were torn, making it obvious that the bowel had not traversed the abdominal inguinal ring. The spermatic cord and the ilio-inguinal nerve were isolated and the edematous cremater muscle removed. Loose fibers of the external oblique aponeurosis were cut away, and the rent in the peritoneum repaired with interrupted sutures of "heavy duty" mercerized white cotton thread. The transversalis fascia was approximated to the shelving edge of the inguinal ligament, and the conjoined tendon fastened to its normal insertion

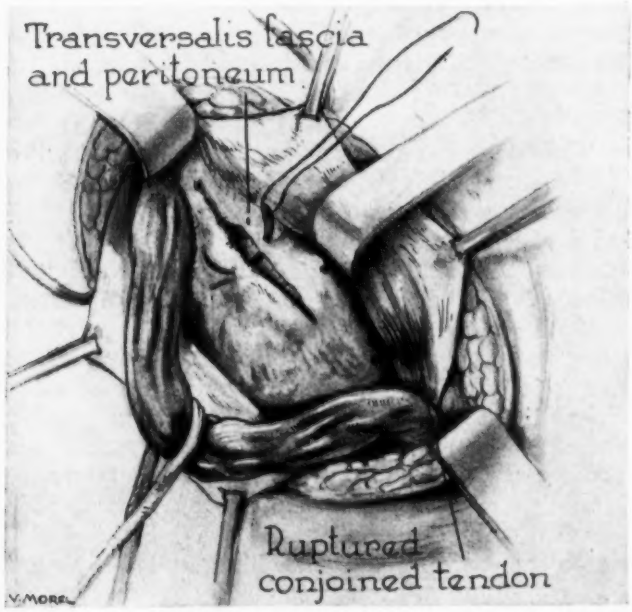

Fig. 3.

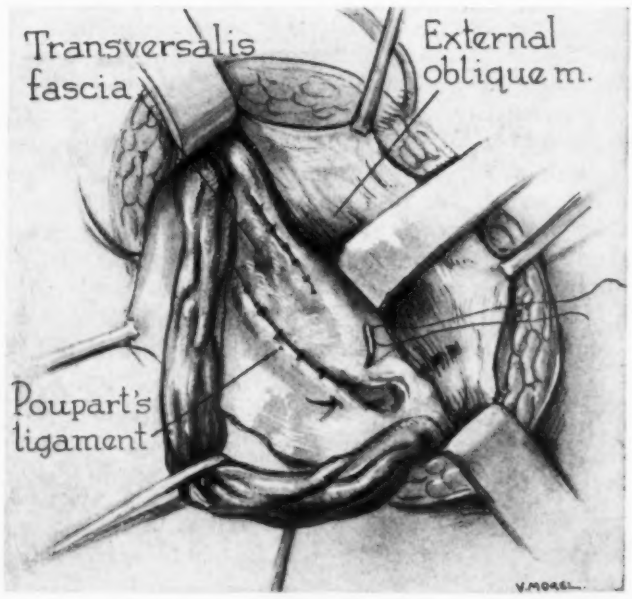

Fig. 4.

on the symphysis pubis by means of three interrupted sutures of heavy duty mercerized cotton thread. (Fig. 4). The lateral edge of the conjoined tendon was then sutured to the shelving portion of the inguinal ligament anterior to the transversalis fascia. The divided external oblique aponeurosis was then approximated with some difficulty due to the edema of the underlying structures. Scarpa's fascia was then approximated with interrupted sutures of No. 60 spool cotton thread, and the skin with mercerized thread. Due to the edema present, it was deemed inadvisable to employ fascia lata in as much as the tissue so affected presented an excellent medium for microorganismal growth.

The patient had an uneventful recovery and was discharged 14 days later without any evidence of hernia.

Comment

THERE were admitted during the past two years to Charity Hospital, New Orleans, 1634 hernias of all types originating from defects in the abdominal parieties, only one of which was traumatic in origin. We have operated upon many cases of alleged traumatic hernia shortly after the so-called "injury," only to find the familiar picture of weak muscles, enlarged opening in the fascia, and a sac. No extravasation of blood or serum, and no evidence of lacerated tissue was seen except in the case reported here.

As has been pointed out, the fact that many patients are not cognizant of an existing hernia, while others are able to conceal the defect from their families and close friends makes a history of trauma one which should be viewed with skepticism, particularly if an examination is not done shortly before the onset of symptoms.

Summary

THE designating term "traumatic" should be reserved for those cases of hernia which are characterized by a definite history of local injury, evidenced by the symptoms of severe abdominal pain, vomiting, prostration, and the appearance of a mass at the site of injury. The signs are exquisite local tenderness, on manipulation of the mass, ecchymosis, loss of anatomical continuity of structures, and absence of a peritoneal sac. All other hernias are of congenital origin, and may be precipitated by "effort."

2. The case presented herewith is one of a 58 year old Negro male who was struck in the right inguinal region by the handle of a plow. No immediate pain or disability ensued, and the patient was able to continue his work. After eating his next meal, abdominal pain and vomiting occurred, and for the first time in his life he noticed a swelling in his right groin. Subsequent surgical exploration revealed a right, direct, interstitial, inguinal hernia with no sac and obvious evidence of traumatic etiology.

3. The repair was carried out with cotton suture material.

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From the Archives

IN AN editorial of the *Journal of the A. M. A.*, January 4, 1930, industrial medicine has been officially recognized as a challenging specialty that is threatening to disturb the smug complacency of organized medicine; that plans must be considered for curbing its activities and it must confine those activities to its 'just and proper domain' and relinquish those functions which are 'beyond its legitimate field.'

"Industrial medicine after many years of a tolerated existence is at last coming into its own. Its recognition is due not to the employment of bombastic methods or the assumption of 'holier than thou' attitudes, but because its devotees, and I use the word devotees with premeditation, have gone ahead and done those things unusually well that industry has required of them and gradually and subtilely proved their superior ability, over that of the general practitioner or any other group of medical men, in solving the medical problems of industry."

From the "Secretary's Report," by Volney S. Cheney, M.D., Secretary, June 22, 1930, in the *Bulletin of the American Association of Industrial Physicians and Surgeons*, September, 1930.

Pre-employment Examinations

—and Related Activities of the North Carolina Division of Industrial Hygiene—

M. F. TRICE, *Industrial Hygienist,*
Division of Industrial Hygiene of the North Carolina State Board of Health and the North Carolina Industrial Commission

THE North Carolina Workmen's Compensation Act makes compulsory the examination of employees and prospective employees engaged, or about to engage, in an occupation which has been found to expose them to the hazards of asbestosis or silicosis. Inasmuch as the execution of this requirement by practicing physicians in all parts of the State would bring varying degrees of experience to bear on the problem with a probable resulting lack of uniformity in findings, the responsibility for such examinations was assumed by the Industrial Commission. The Division of Industrial Hygiene, as a conjoint activity of the Industrial Commission and the State Board of Health,[1] was assigned this task.

A mobile x-ray laboratory, which has been fully described elsewhere,[2] is employed in making employee and pre-employment examinations of workers in the siliceous dust industries of the state. The routine examination includes complete occupational, family, and past medical histories. In taking the occupational history all jobs held by the worker are listed consecutively in reverse order, beginning with the present employment. For each job so listed there are recorded the industry involved, classified as to dusty or nondusty; the years spent therein; and information regarding the working environment. With respect to the family history, particular attention is given exposures to pulmonary tuberculosis. The medical history is concerned primarily with the incidence of respiratory diseases. For the physical examination a worker is required to strip to the waist, whereupon a record is made of the general appearance, height, weight, usual weight, and the gross defects, if any, of eyes, ears, nose, and throat. The heart is examined, and the blood pressure readings are recorded. With respect to the chest, the examination includes inspection, palpation, percussion, auscultation, and measurements at full expiration and at full inspiration. Symbols are used to indicate on chest diagrams the percussion and auscultation findings. In addition, clubbing of the fingers, bowing of the nails, edema, and cyanosis are recorded when found. There follows the taking of a blood specimen, which is mailed to the State Laboratory of Hygiene for a serological test for syphilis. An x-ray of the chest is then made. In some cases fluoroscopic examinations and tuberculin tests are included, and the

.....Pre-Employment
.....Routine
.....Re-Exam.

DIVISION OF INDUSTRIAL HYGIENE
N. C. STATE BOARD OF HEALTH
AND
N. C. INDUSTRIAL COMMISSION
(ADMINISTERING THE WORKMEN'S COMPENSATION ACT)

No.....
Date.....

CASE RECORD

Name ..... (Surname) (First Name) Date of birth.....
Address ..... County.....
Age..... Sex..... Color..... Racial Stock..... M. S. W. D. Sep.
Plant ..... Address.....
Family Physician..... Address.....

OCCUPATIONAL HISTORY

SPECIFIC JOB	INDUSTRY	YEARS DUSTY	YEARS NON-DUSTY	WHERE	WORKING CONDITIONS CONTROL MEASURES, ETC.
Pres.					
Prev.					
"					
"					
"					
"					
"					
"					
"					
"					
"					
"					
Total Years					

FAMILY AND PAST MEDICAL HISTORY (INSERT DATE WHEN POSITIVE)

Family history of T. B. .....
Exposure to T. B. .....
Tuberculosis..... Treatment..... Pleurisy..... Dry..... Wet..... Side.....
Hemoptysis..... Dates..... Amount..... Asthma..... Hay Fever.....
Pneumonia..... Empyema..... Bronchitis..... Sinus Diseases.....
Influenza..... In bed..... More colds in recent years.....
Average number of colds yearly..... Head..... Chest..... Duration..... Severity.....
Tonsilitis..... Previous injuries.....
Operations..... Heart Disease.....
Rheumatic Fever..... Scarlet Fever..... Hypertension.....

G. I. ..... Skin diseases.....
G. U. ..... Nervous system.....
Menstrual ..... Pregnancies.....
Other serious illnesses or complaints.....

PRESENT HEALTH

Cough..... How long..... Type..... When worse.....
Productive..... Amount..... Character..... Odor.....
Dyspnea..... Duration..... Severity..... Progressing.....
Appetite..... Digestion..... Bowels..... Edema.....
Strength and energy..... Hernia.....
Weight: Stationary..... Lost..... Gained..... How long.....
Other complaints.....
Progress of symptoms.....

HABITS

Alcohol ..... Sleeping .....
Tobacco ..... Eating .....

PHYSICAL EXAMINATION

General Appearance..... Hair..... Eyes..... Ht..... Wt..... Us. Wt.....
Skin and mucous membrane..... Nose..... Mouthbreather.....
Eyes: Pupils regular..... Irregular..... React to light R..... L..... Glasses.....
Ears: Hearing..... Discharge..... Throat: Tonsils..... Pharyngitis.....
Teeth..... Gums..... Pyorrhea.....
Glands: Thyroid, Normal..... Cervical..... Epitrochlear..... Axillary.....
Blood pressure..... reflexes.....

Exercise		Rate at rest	Exercise	After 2 minutes rest
Pulse:	regular			
	irregular			
Respiration				

Fig. 1. Pages 1 and 2 of the four-page case record form

collection of sputum specimens occasionally is arranged. A four-page case record form, Fig. 1, is employed to facilitate the recording of the data obtained.

At the conclusion of the examination a worker is informed of any condition that should have immediate attention, such as high blood pressure, for example, and is advised to consult a local physician.

The x-ray films are brought into the Division offices for developing. Only an occasional film is processed in the mobile x-ray laboratory darkroom, usually to check quality when the supply line voltage is found to fluctuate considerably.

In the office each film is carefully studied and the reading correlated with the physical examination data. Finally, the result of the serological blood test for syphilis is recorded, and the diagnosis is then entered on the case record form, thus completing the case.

When the case records have been finished, a letter is written to each company (with copies going to the Industrial Commission and Compensation Rating and Inspection Bureau) outlining the results of the examinations. Attached to such communications are pre-employment examination certificates, Fig. 2, for all new employees deemed fit for employment in dusty trades. Certificates are not issued for routine workers that have been examined. The company letter, however, contains a report on all such persons and advises with respect to them that, if any decide to change jobs, certificates will be issued upon request. It may be well to state at this point that certificates are issued for two years and permit the men to change jobs without further examination during the period. The certificate issued a worker is not renewed at the end of two years if he elects to remain at his present job.

Persons considered unfit for employment in dusty trades are rejected and the reasons for such action cited. Personal letters concerning their conditions are sent all individuals who should have medical attention, and they are advised to consult a local physician and, in some instances, a dentist. Whenever pulmonary tuberculosis is found or suspected, the worker is appraised of such condition and referred to a local or state sanatorium. A letter relative to the condition of the worker is sent also to the sanatorium mentioned in the employee's letter.

Upon receipt of the results of the serological blood tests for syphilis a form letter, Fig. 3, is dispatched to all employees whose blood gave a positive reaction to either the Wassermann or the precipitin test. This letter advises them to see their family physicians or county health officers at once. The results of the blood tests are sent to the county health officers in order that they may enforce treatment under the Public Health laws of the

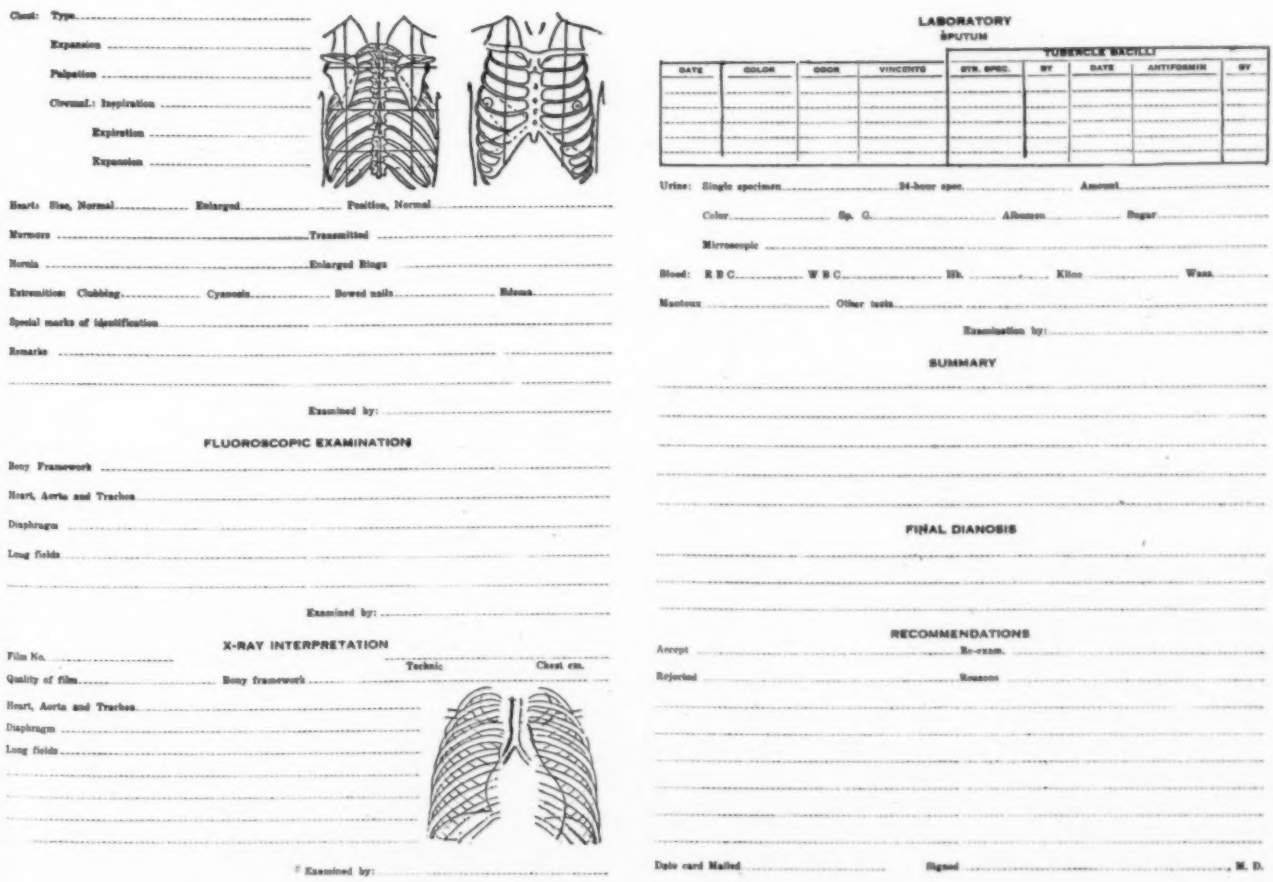

Chest: Type
Expansion
Palpation
Clvcmsl.: Inspiration
Expiration
Expansion
Heart: Size, Normal Enlarged Position, Normal
Murmurs Transmitted
Hernia Enlarged Rings
Extremities: Clubbing Cyanosis Bowed nails Edema
Special marks of identification
Remarks
Examined by:
FLUOROSCOPIC EXAMINATION
Bony Framework
Heart, Aorta and Trachea
Diaphragm
Lung fields
Examined by:
X-RAY INTERPRETATION
Film No. Technic Chest cm.
Quality of film Bony framework
Heart, Aorta and Trachea
Diaphragm
Lung fields
Examined by:
LABORATORY
SPUTUM
DATE COLOR ODOR VINCENT'S TUBERCLE BACILLI: STR. SPEC. BY DATE ANTIFORMIN BY
Urine: Single specimen 24-hour spec. Amount
Color Sp. G. Albumen Sugar
Microscopic
Blood: R B C W B C Hb. Kline Wass.
Mantoux Other tests
Examination by:
SUMMARY
FINAL DIANOSIS
RECOMMENDATIONS
Accept Re-exam.
Rejected Reasons
Date card Mailed Signed M. D.

Fig. 1. Pages 3 and 4 of the four-page case record form

state.[3] Such information, however, is not sent employers, as the diseased workers might be discharged. When employers specifically request information on the blood tests, as only two have done thus far, they are informed that individual reports will be sent the workers and that they in turn may require their employees to turn in such reports. This is done, however, only after the employer has agreed that no syphilitic workers will be discharged so long as they will undergo treatment.

The filing of records is facilitated by the use of serial numbers. Prior to the examinations a supply of case record forms is numbered serially. Then, before an x-ray film is made the technician correlates the name of the worker with the case

PRE EMPLOYMENT EXAMINATION CERTIFICATE

Name ..... No.....
Address ..... Age .....
Color..... Ht..... Wt.....
Hair ..... Eyes ..... Sex .....
Special marks of identification.....
.....
.....
(Applicant's Signature in Full)
Remarks: .....
NOTE: Employer should be certain that applicant fits description and signature corresponds.

(Front)

Show this card when applying for a job.

This is to certify that a physical examination and chest X-ray have been made on the above individual. I recommend him as being physically fit for employment in dusty trades.

This card will be acceptable in securing new jobs in dusty trades any time within two years from date of this examination. After two years applicant must be reexamined if he applies for a new job.

Signed.....M.D.
Director, Div. Indus. Hygiene
State Board of Health
Date
Chm. Advisory Med. Committee
..... N. C. Industrial Commission

(Reverse)

Fig. 2. Pre-employment examination certificate card given all new workers deemed fit for employment in the siliceous dust industries

record form and affixes in the conventional manner the number of the latter to the film. In the office the x-ray films are filed numerically and the case record forms, or charts as they are sometimes called, alphabetically. A numerical record, Fig. 4, containing the names of the workers, the employers, and the dates of examination, together with a Kardex file holding individual cards, Fig. 5, for all persons examined provide a cross index for films and case records. In addition, a company record, Fig. 6, is kept which contains the names of the employees, the serial number for each worker, the individual diagnoses, and the date, or dates of all examinations.

An alphabetical record of the serological blood tests for syphilis is maintained. And, finally, a list of the names of persons to be re-examined is kept by company in order to expedite the work of the examining physician. An alphabetical card file, Fig. 7, is carried in the truck which pulls the mobile laboratory. This portable file furnishes valuable information while the x-ray unit is in the field, particularly with respect to re-examinations.

THE mobile x-ray laboratory visits at least twice a year every plant in the State in which there exists a siliceous dust hazard. The industrial centers of the state, however, are usually visited more frequently — once in a quarter, in fact, some years. Obviously, the scheduling of such trips depends upon the number of new employees inasmuch as most of the old workers in the siliceous dust industries have been examined. Therefore, the majority of examinations being made at present are pre-employment cases or re-examinations.

Although the Workmen's Compensation Act requires that all persons selected for employment in occupations that will expose them to the hazards of asbestosis or silicosis be given pre-employment examinations, it is recognized that frequently it may be several weeks before the Division's examining unit will make a visit to a plant; consequently, an employer is permitted to hire conditionally new workers provided a pre-employment statement, Form 6 O.D., Fig. 8, properly executed by a plant official, is made out for each worker and submitted to the Division. These forms may be more correctly termed questionnaires inasmuch as they are designed to provide information on the physical condition of a worker. The forms are supplied employers upon request.

Upon its arrival in the Division offices, Form 6 O.D. is examined by a physician; and, if no questions are raised with respect to the information submitted, it is filed under the name of the company. The filing of the form signifies that a person is approved for employment subject to an examination at a later date. A letter relative to the information provided is not sent the employer unless further information is desired or it appears that an individual may be more susceptible than an average person to the dust diseases. Whenever the question of increased susceptibility is raised, the company is required to have the prospective worker examined and x-rayed by a local physician and the record of such examination, together with the x-ray film, sent to the Division offices for study. To date, however, very few forms have been questioned. The file of 6 O.D. forms is used in planning itineraries for the examining crew.

AS AN agency of the North Carolina Industrial Commission, the Division occasionally must provide information relative to compensation litigation. Whenever a claim for compensation based upon an allegation of disability resulting from silicosis or asbestosis is scheduled for a hearing,

the Industrial Commission requests a medical report on the claimant. As virtually all of the routine workers in the siliceous dust industries of the State have been examined, such case reports are prepared by the Director of the Division usually from information already on file. Case reports are never sent directly to the attorneys but to the Industrial Commission, which forwards them to the legal representatives of the insurance carrier and the plaintiff, respectively. Only rarely is a copy of the report sent to the employer. Not infrequently the claimant is examined again prior to the preparation of a case report notwithstanding the fact that medical data on the person are already on file. Whether a second examination is made purely for use in uncontroverted litigation depends largely on how accessible the examining physicians are to the claimant. It occasionally

NORTH CAROLINA
STATE BOARD OF HEALTH
RALEIGH

December 11, 1939

Mr. John Doe
Blanktown, N. C.

Dear Sir:

Dr. J. H. Hamilton, Director of the State Laboratory of Hygiene, reports that the specimen of blood taken from your arm when we examined you recently shows a positive Wasserman and a positive Precipitin Test. These are tests for syphilis, sometimes called pox or bad blood.

You should take this letter to your doctor, who will talk to you about the results of the blood tests and will make whatever additional tests and examination he thinks necessary to enable him to decide definitely whether or not you do have syphilis. Also, he will tell you what, if any, treatment you need and will arrange for you to get it if possible.

If you have taken some treatment for your blood in the past and believed that you were cured, the results of the above tests indicate that you probably did not continue the treatment long enough. If your doctor decides this is the case, he will advise you concerning further treatment.

Syphilis is a very treacherous disease, and you may have it for years and still feel perfectly healthy, but unless you are given enough treatments to cure you the disease is very likely to cause serious sickness later on in life.

It would be well, I think, for you to take the other members of your family to the doctor, too, for blood tests.

Let me urge you again to take this letter to your doctor as soon as possible. The sooner treatment is begun in a case of syphilis, the better the chance for obtaining a cure.

Very truly yours,

Division of Industrial Hygiene

Fig. 3. Form letter sent each employee whose blood gave a positive reaction to either the Wassermann or precipitin test for syphilis

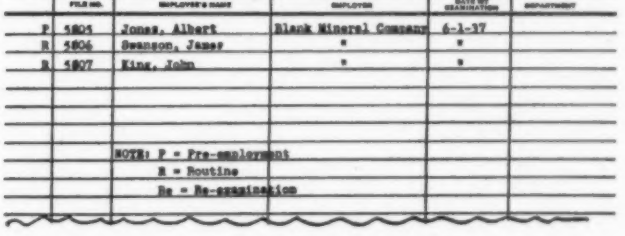
happens that the field unit is stationed, or the Division offices are located, sufficiently near the home of the worker to justify his presenting himself at his expense for examination; whereupon, the Industrial Commission suggests in a letter to the claimant that such be done.

With respect to the handling of controverted claims for compensation involving silicosis and asbestosis, the Workmen's Compensation Act provides for an Advisory Medical Committee of three physicians peculiarly qualified in the diagnosis or treatment of occupational diseases. The Director of the Division is Chairman of this committee. Under the Act the employee, if living, must "appear before the Advisory Medical Committee at the time and place specified . . . and shall submit to such examination, including clinical and x-ray examinations, as the Advisory Medical Committee may require." With respect to the report of the Advisory Medical Committee the law states:

"(s) The Advisory Medical Committee shall, as soon as practicable after it has completed its consideration of a case, report to the Industrial Commission its opinion regarding all medical questions involved in the case. The Advisory Medical Committee shall include in its report a statement of what, if any, physician or physicians were present at the examination on behalf of the claimant or employer and what, if any, medical reports and x-rays were produced by or on behalf of the claimant or employer."

The Advisory Medical Committee has been called for testimony at almost all of the hearings involving silicosis and asbestosis. The reasons for many of such compensation claims progressing to formal hearings are varied. In some instances claims have been contested by the insurance carriers and in others by the injured employee and his attorney, who failed to agree with the Advisory Medical Committee and sought a hearing to controvert its conclusions. Then, too, a former chairman[4] states that the Industrial Commission more or less encouraged such hearings in the early days of the administration of the occupational disease act. The law was new, according to this former official, and the opinion of the Commission on many points had not been published. It was deemed in the best interests of all concerned that these cases come to a hearing.

Frequently the Director of the Division submits to the other two members of the Advisory Medical Committee for opinion the x-ray films and other



NUMERICAL LIST—EXAMINATIONS
EMPLOYEES EXPOSED TO OCCUPATIONAL DISEASES

NORTH CAROLINA INDUSTRIAL COMMISSION

	FILE NO.	EMPLOYEE'S NAME	EMPLOYER	DATE OF EXAMINATION	DEPARTMENT
P	1905	Jones, Albert	Blank Mineral Company	6-1-37	
R	1906	Swanson, James	"	"	
R	1907	King, John	"	"	

NOTE: P = Pre-employment
R = Routine
Re = Re-examination

Fig. 4. Loose leaf ledger containing numerical record of examinations

data for workers whose removal from the dusty trades is under consideration.

The physicians of the North Carolina Division of Industrial Hygiene in the four years of its existance have performed three autopsies. One of them involved a claim for compensation based on exposure to asbestos dust as the cause of death, and two of the autopsies were performed on former pyrophyllite workers. In this connection, the North Carolina Workmen's Compensation Act contains a provision that is unusual in legislation of this character. It provides that, in the event a postmortem examination appears desirable to establish the validity of a claim, the Industrial Com-

mission may order such a procedure. If such an examination is denied by the surviving spouse or next of kin, all right to compensation ceases.

As of November 1, 1939, approximately 9432 persons had been examined since the organization of the Division in September, 1935. During the first two years no attempt was made to segregate pre-employment from employee cases on the office records. Beginning about August, 1937, however, such a classification was begun; and to date (November, 1939) 4850 examinations have been made, 2340 of which have been pre-employment cases. With respect to the health of workers in North Carolina, the reader is referred to several published sources. [1,5,6,7,8,9]

Employee ..... Address .....

Employer ..... Address .....

1st Exam. 6-1-37 By ..... X-ray No. 5807

2nd Exam. 6-12-38 By ..... X-ray No. 7200

3rd Exam. 5-20-39 By ..... X-ray No. 8902

4th Exam. ..... By ..... X-ray No. .....

5th Exam. ..... By ..... X-ray No. .....

Name	Employer	X-ray No.
King, John	Blank Mineral Co.	5807

Fig. 5. Kardex Record for each person examined

EMPLOYER'S RECORD EXAMINATIONS OF EMPLOYEES

EMPLOYER (Blank Mineral Company LOCATION Blank, N. C.

BUSINESS CARRIER

NUMBER OF EMPLOYEES POLICY NO. YEAR 1937 CARD NO. 1

FILE No.	EMPLOYEE'S NAME	DISCOVERIES	1st Ex.	2nd Ex.	3rd Ex.	4th Ex.	5th Ex.
1804	Jones, Albert	Mild Pneumonium	6-1-37				
1805	Swanson, James		6-1-37				
1807	King, John	Silicosis	6-1-37	6-12-38	5-20-39		

Fig. 6. Loose leaf ledger containing record of examinations by company

Name King, John Date of birth 6-17-01 Age 36

Address Blank, N. C. Color W

1ST EXAMINATION

No. 5807 Date 6-1-37 Plant Blank Mineral Company

Preemployment Routine * Card Issued

Remarks To be re-examined in one year

Diagnosis Silicosis

2ND EXAMINATION

No. 7200 Date 6-12-38 Plant Blank Mineral Company

Preemployment Routine * Card Issued

Remarks To be re-examined in one year

Diagnosis Silicosis

(Back of Card)

3RD EXAMINATION

No. 8902 Date 5-20-39 Plant Blank Mineral Company

Preemployment Routine * Card Issued

Remarks To be re-examined in one year

Diagnosis Silicosis

4TH EXAMINATION

No. ..... Date ..... Plant .....

Preemployment ..... Routine ..... Card Issued .....

Remarks .....

Diagnosis .....

Fig. 7. Alphabetical card file in portable x-ray unit

[ACKNOWLEDGMENT: Grateful acknowledgment is made of the services of MISS KATHRYN SCROGGS, Division Secretary, who supplied much of the information on the forms employed and office pro-

Form 6-O.D.

NORTH CAROLINA INDUSTRIAL COMMISSION

RALEIGH, N. C.

PRE-EMPLOYMENT STATEMENT

of Prospective Employee to Employer and Medical Advisory Committee

Date ..... 193..

Name of Employer: Address: Employer's Code No.

Name of Applying Employee: Address: Age:

For what periods of time have you resided in N. C.?

OCCUPATIONAL HISTORY

1. In what places have you worked:

	Employer	Address	From	To	Kind of Work
Last:					
Next Before:					
Next Before:					
Next Before:					

2. Have you ever undergone a medical examination for insurance and failed to receive the exact amount or kind of policy applied for? If yes, give particulars and name company.

Answer:

3. Have you ever resided or been intimately associated with any person suffering from tuberculosis? If so, when and how long?

Answer:

4. Has any one of your parents, brothers or sisters or grandparents now, or ever had, tuberculosis, cancer, diabetes, epilepsy, insanity, or any hereditary disease? If yes, give particulars.

Answer:

5. Have you ever been an inmate of, or have you ever received treatment at any asylum, sanatorium, hospital, or cure? If yes give date, duration, name of ailment and name of institution.

Answer:

6. Have you ever on account of any disease or condition of your health received or applied for a pension or disability or compensation benefits from any government or from any municipal or private corporation, or have you ever received or applied for any benefit under a policy of health, workmen's compensation or fraternal insurance? If yes, state reason in full.

Answer:

7. Have you ever taken insulin treatment? If yes, state dates and for how long.

Answer:

8. Have you ever used opium, chloral, cocaine, or other narcotics?

Answer:

9. Have you ever suffered from any ailment or disease of:

	Yes or No	Plant Ailment Disease	Number Attacks	Dates	Duration	Severity	Recover? **
The brain or nervous system							
The heart							
The stomach or intestines, liver, kidneys, or genitourinary organs							
The skin, bones, glands, ears, or eyes							
Have you ever had rheumatism, gout, or syphilis							
Have you ever had asthma							
Have you ever had bronchial trouble							
Have you had any other chronic disease of the lungs							
Have you ever had paralysis or insanity							
Have you ever had diabetes or pneumonia							
Have you had pleurisy? If so, was it wet or dry?							
Was it necessary to draw fluid from your lungs?							
Have you ever raised or spat blood? If so, give details							
Have you ever had asbestosis, silicosis or any occupational disease							
Have you ever had any surgical operation							
Have you consulted a physician during the past 5 years for any ailment or disease not included in your above answers? For what illness							

(Answer yes or no)

** If recovery was complete, state how and from whom did you learn same?

10. Are you now in good health?

11. Are you subject to frequent colds?

12. Do you have sinus trouble?

13. Do you have frequent attacks of tonsilitis?

14. Are you short of breath after exercise?

15. Have you lost or gained weight during the last two years? How much?

I, hereby, certify that I have read the answers to the above questions before signing, and that they have been correctly written, as given by me, and that they are full, true and complete, and that there are no exceptions to any such answers.

WITNESS: Signature of Applicant

EMPLOYER'S STATEMENTS

1. What is applicant's general appearance as to health? Good Fair Poor

2. Are you accepting or refusing this applicant for employment?

3. Are you delaying employment of applicant until a physical examination can be made?

SIGNATURE OF PERSON RECORDING ANSWERS:

POSITION WITH COMPANY:

Fig. 8. Form 6-O.D. Pre-employment statement

cedures. The manuscript was reviewed critically by DR. H. F. EASOM, former Director of the Division, and by MESSRS. J. DEWEY DORSETT and T. A. WILSON, former and present Chairmen, respectively, of the North Carolina Industrial Commission.]

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3. Public Health Laws of North Carolina, Art. 15, especially sections 7191-7198, inclusive.

4. DORSETT, J. DEWEY, Manager Casualty Dept., Assn. Casualty and Surety Executives, New York City, formerly Chairman, North Carolina Industrial Commission.

5. DREESSEN, W. C., DALLAVALLE, J. M., EDWARDS, T. I., MILLER, J. W., SAYERS, R. R., EASOM, H. F., and TRICE, M. F.: A Study of Asbestosis in the Asbestos Textile Industry. *Public Health Bull.* 241. Washington, Gov. Print. Off. 1938.

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9. DREESSEN, W. C., DALLAVALLE, J. M., EDWARDS, T. I., SAYERS, R. R., EASOM, H. F. and TRICE, M.F.: Pneumoconiosis Among Mica and Pegmatite Workers. *Public Health Bull* 250. Washington, Gov. Print. Off. 1939.

Integration of Industrial Hygiene with Industrial Medicine

H. G. DYKTOR,

Chief Industrial Hygiene Engineer, Bureau of Industrial Hygiene, Michigan Department of Health

IT WILL greatly facilitate matters if I explain what the title of my subject "Integration of Industrial Hygiene with Industrial Medicine" means to me. An abstract discussion is never as illustrative as "getting down to cases." And by this token I want it understood that I shall regard "industrial hygiene" as meaning an official industrial hygiene unit and "industrial medicine" as meaning a plant medical unit.

Now that the definition of the title is out of the way, it behooves us to consider briefly the purposes and objectives of these units before we can talk intelligently about integration of their efforts.

The main reason for the existence of an official hygiene unit is the presence of occupational health hazards in industry. Therefore its objective is the elimination or control of these hazards. These two fundamental considerations are clear cut in the case of the official agency.

Read before Conference on Industrial Medicine and Hygiene held at Ann Arbor, Michigan, on January 12, 1940.

In the case of the plant medical unit, these issues are somewhat obscured, in my opinion, because of the belief that altruism has no place in commerce. Heretofore, the main reason for the existence of a medical unit in a plant seemingly was plain economics. A worker was hurt or wounded in the plant and he was sent at once to be looked over by the plant surgeon. It was this surgeon's job to rehabilitate the worker and thus save the company an excessive financial loss through unnecessary neglect. However, today the policy of industry has undergone a change. In the first place, pre-employment and periodic medical examinations are the order of the day and physicians must understand the purpose behind these examinations. As a result, prevention rather than cure is gaining rapidly in prominence. In the second place, industry realizes that the welfare of employees is an important feature of success in any enterprise and that it is good business to have men and women healthy. Therefore this more recent concept makes the purpose of a plant medical unit the elimination or control of all hazards to the health of employees within its jurisdiction.

Placing side by side the purposes of the official industrial hygiene unit and of the plant medical unit, it will be noticed that they are very similar in their objectives and that there is a tremendous amount of common ground upon which they can cooperate to the fullest extent. However, this cooperation is predicated upon the assumption that the personnel of both units is qualified and competent. I take it for granted that the official industrial hygiene unit is composed of trained and experienced professional men, both engineers and physicians and that the plant medical unit is under the guidance of a physician trained and experienced in internal medicine as well as some of the other phases of medical work. I make these assumptions knowing quite well that at present they are not always encountered in practice. However, we must always strive for the ideal and at no time is the ideal more important than in this instance. If the foregoing requirements are met there will be mutual respect and confidence and the problem of integrating the efforts of both units is very much simplified. Unfortunately, many times this mutual confidence does not exist because of lack of training on the part of either unit.

Speaking of the personnel of the official industrial hygiene units, it must be admitted that great strides have been made during the last few years to train and qualify personnel for the positions they hold in these units and I feel sure that the prospects are good. I hope that they are particularly good in regard to inculcating an appreciation of the public health significance of the many things we do in industrial hygiene. As regards the status of the industrial physicians, I cannot do better than to refer you to a paper read on this subject by DR. C. D. SELBY before the Second Annual Mid-West Conference on Occupational Diseases held in Chicago in 1938. In that paper DR. SELBY expressed himself to the effect that it was difficult to understand how any except full-time physicians could be in a position to assume appreciable responsi-

bility in industrial hygiene in a plant. The extent to which they do depends on their knowledge, vision, professional ability and capacity to organize or fit into the organization that employs them. Here, too, the prospects are good because of the interest in industrial hygiene exhibited by the profession as a whole.

ACCEPTING the foregoing assumptions and predicates, let us consider some of the services that these units can render to each other in order to attain their common objectives.

I shall first list the services that the official industrial hygiene unit can and should furnish to the plant medical unit and briefly discuss each item as I go along:

1. Make special tests, examinations and studies which the plant medical unit is not equipped or qualified to perform.

This is a field in which the industrial hygienists excel, and since they are specially trained to make these tests and examinations they should be called in by the plant medical unit any time their services are required. These services include taking samples of possibly contaminated air, samples of materials, physical determinations of heat, light and ventilation, and many other items too numerous to mention; studies that include occupational analyses, improvements in or design of exhaust ventilation, and similar duties.

2. Provide detailed and specific information on toxic substances and harmful conditions.

It is possible that a plant medical unit might gather this type of information without recourse to the industrial hygiene unit but on the other hand this unit is as a rule well documented, is in constant touch with the other agencies, and possibly has sources of information that may not be as regularly available to the plant unit as they are to the official unit. Furthermore, library work, correspondence, etc., takes up a great deal of time and the physician in charge of the plant unit may be too busy to readily devote time and thought to obtaining such information when perhaps it might be immediately available at the nearest industrial hygiene unit.

3. Provide comparable statistics on other plants in the same industry.

In the case of a plant medical unit of a subsidiary or branch of a large parent corporation, this type of information may be readily available; however, in most cases it is not. The official agency, by virtue of the fact that its jurisdiction covers a wider geographical area, is in a position to gather the required statistics on all the plants of the same industry. It is able to furnish the information without a great deal of trouble to the plant medical unit that may require it. This information can then be used by this unit to compare the incidence of certain diseases in its plant with that of others and thereby judge whether or not it is making a good job.

4. Furnish industrial health statistics duly interpreted.

We all know that it is most helpful to have statistics interpreted to us unless we are statisticians. This is one of the duties that can be performed by an official agency since it is in a position to compare various statistical reports, extract the essential information and pass it on to the plant medical unit in digested and simplified form. As a rule interpretations of statistics bear the imprint of the interpreter's personal views, that is a common experience. It behooves, therefore, a neutral interpreter to separate the wheat from the chaff and that neutral interpreter can be the official agency.

5. Correlate work of industrial hygiene in many plants to obtain uniformity.

I do not mean uniformity merely for the sake of uniformity. I do mean, however, uniformity of the type which will make results susceptible of comparison. Results which can be used as a yardstick to permit subsequent judgement whether or not a good job is being done to clean up certain hazards. For instance, judicious steering counsel may be given so that certain more important hazards may receive attention before less important ones are tackled. Methods of control may be straightened out so that blind alleys may not be encountered. All this counsel and advice should, of course, be based on actual experience.

6. Work with and through plant medical unit to obtain specific improvements, better housekeeping and sanitation, etc.

This statement requires a somewhat longer discussion because it involves more than appears on the face of it. An official industrial hygiene unit cannot work with a plant medical unit if it has no confidence in the physician for the reason that he is inexperienced, untrained or unmindful of his responsibility, and the same remark applies when the conditions are reversed. If, however, both units are qualified to render the service for which they are employed, then it becomes a pleasure to work with each other and good results can be expected. For instance, tests, examinations and observations can be made, recommendations can be discussed, and since the plant medical unit is close to the management, as it should be, it is far more preferable and the official agency will gladly accept that the execution of the recommendations be done through the medical unit. This remark applies not only to questions of air contamination, toxicity, but also to the just as important questions of housekeeping, sanitation of the plant, and other conditions affecting the health standard in a plant.

7. Stimulate plant medical unit to concentrate on preventive measures.

Official industrial hygiene units are naturally concentrating their efforts on prevention since a case of sickness to them is a sign that preventive measures have failed in some place. The question of cure, of course, is one that quite properly should be assigned to the practicing physicians. Since the training of the present-day physician is such that the curative side of medicine has been greatly stressed, in fact dominates the preventive side, it is within the nature of present-day experience that such a physician will unconsciously relapse and

give more weight to cure than to prevention. It is therefore the duty of the official agency to stimulate prevention by visiting the medical units within its jurisdiction at regular intervals and discussing and stressing the installation of preventive measures with the idea of affording greater protection for the industrial workers.

8. Stimulate the plant medical unit to interest itself in the worker's life beyond the confines of the plant.

The industrial worker lives as normal a life as any other worker and beyond his daily stretch in the plant is exposed to the same hazards as any other member of his community. In the present day concentration of effort on improving the environment for the industrial worker, sight must not be lost of the fact that his health depends not only on that working period but also on the sanitary conditions under which his food is prepared, on the conditions under which he is housed, and many other like problems. These are, of course, community problems but just the same a properly trained and efficient plant medical unit will endeavor to interest itself in the living conditions of its men beyond the plant, knowing full well that the health hazards encountered by these men outside of the plant will have an effect on their efficiency in the plant. The plant physician has a wonderful opportunity to serve not only his workers but the community at large and if he bears this concept in mind he will truly be the health officer for his jurisdiction.

The above concludes in general what the official industrial hygiene unit can do to assist the plant medical unit to improve its program and facilitate accomplishments.

LET us now consider what the plant medical unit can do to help itself, assist the local official agency and thereby make its contribution to the solution of the problem of improving the health of the community in which it is located. Here, too, I shall list the items and discuss each:

1. The sincere desire to improve the health of the workers.

This statement sounds very altruistic but it is indispensable to any and all efforts. I said that the desire must be sincere, not just lip service, and the whole organization of the plant medical unit must be pervaded with the desire to raise the health standard of the plant workers and maintain it at a satisfactory level. By satisfactory level I mean the same statistical level at which the health of non-industrial workers of the same economic class is maintained. Curative efforts should continue but the preventive efforts must predominate.

2. Support the official industrial hygiene unit in its educational campaign to make both employers and employees as health conscious as they are accident conscious.

As a rule the personnel of the official agency is not large enough to give individual attention to each and every plant within its jurisdiction. It must, therefore, rely to a great extent on other allied agencies to multiply its efforts, and in a plant that has its own medical unit what better agency would be qualified than it to spread the word about prevention of disease and care of the health? A well trained and qualified plant medical unit has the confidence of its employees and by judiciously selected talks to the workers, distribution of notices on single features in the prevention program and like efforts, it will contribute materially to the educational campaign which is the basis for all accomplishments in the field of public health. It must be realized that workers have been talked to at considerable length on accidents and accident prevention for many years with excellent results, and a like campaign maintained consistently will make the workers as health conscious as they are now accident conscious.

3. Supplying the industrial hygiene unit with records of absenteeism due to both sickness and accidents, for analytical examination.

Some corporations have already installed this system of keeping records of causes for absence from work of their employees and once or twice in the year these records are classified according to departments and studied by the chief medical supervisor. Such a study, especially when divided according to departments, will sometimes disclose one cause for absence which may be more prevalent than any other and by investigating the reasons for its occurrence it may frequently be possible to eliminate the conditions that give rise to that cause for absence. However, such an analytical study involves a lot of work and consumes a great deal of time; not every plant medical unit can carry out such a study. The official agency, however, is in a position to give the necessary time and thought to this type of work and will gladly undertake it. With the results obtained from such a study the medical unit is informed of any abnormal incidence and the two units can cooperate in investigating the particular department and eliminate, if possible, or control the cause.

4. Advise the official industrial hygiene unit of its own experiences in preventive and control measures, so they may be useful to other plants.

Since the plant medical unit is so close to its own operations it can many times devise preventive and control measures that may be very ingenious, effective and economical. Other medical departments in plants having similar problems as well as the official agency may work for years on them and never solve it so successfully as that particular plant unit. In the interest of general welfare and since there are no financial considerations involved, it is believed that such experiences should be communicated to the official agency so that they may be applied in other locations not so fortunate. In this instance, the official agency acts as a clearing house and if such experiences are communicated to it, it will pass them along and return good for good. The desirable results of such an arrangement are obvious and need no further discussion.

5. Support the official industrial hygiene unit in obtaining recommended improvements as soon as they have been decided upon.

This point really is an extension of the first point which calls for the sincere desire to improve the health of the workers. After all, what is the use of making a study in a plant, spend a great deal of time and thought on recommendations and then find that these recommendations will not be carried out. It is understood that some of the recommendations may involve an important expenditure and it is not expected that some of them will be put immediately into effect; yet steps should be taken to devise means and ways to carry them out as soon as financial and other conditions permit. It will also be found that with the exercise of ingenuity and patience, many recommendations may not involve a great deal of money and these should be put into effect as quickly as possible. In these endeavors the plant medical unit should stand squarely behind the official agency and help the latter to the utmost to effect the necessary accomplishments. It is taken for granted that the recommendations have been agreed upon by both units and that there is no division of opinion.

6. Cooperate with the official industrial hygiene unit on the greater concept of industrial hygiene, i.e., non-occupational diseases, housing, etc.

Under this heading the plant physician must act as the health officer for his plant. He must realize that the time the workers spend in the plant is at the most only one-third of their life cycle and that whatever they do outside of the plant will have an effect upon them when they are working in the plant. For that reason it will be necessary for the plant medical unit to interest itself in the housing and living conditions of its men, and since it has no particular control over these community problems, the plant medical unit should cooperate with the official industrial hygiene unit to bring about improved living conditions.

This concludes the itemization of the main points of contact between the official industrial hygiene unit and the plant medical unit. There are many other points, I am sure, but those I have enumerated seem to me the most important and on these there can and should be united action.

There is no doubt in my mind that each unit can get along without any assistance from the other, but if the job at hand is to be well done then there must be cooperation and coordination of efforts. Those of us who are interested in promoting and preserving the health of the communities in which we operate, and I include in this the personnel of a plant medical unit, realize that we must have the full support of the public to obtain maximum results from our efforts. To obtain these maximum results health workers must present a united front and there is no firmer basis for such a united front than one that is conceived in identity of programs and objectives. Furthermore, the need for such close cooperation between the official industrial hygiene unit and the plant medical unit may have its roots in the seemingly selfish but none the less laudable reason to expand one's efforts. For instance, the official agency can, with the assistance of the plant medical unit, reach a much greater number of industrial workers and by passing on to it some of its responsibilities, devote more time to the care and supervision of the smaller plants. The plant medical unit on the other hand can, with the assistance of the official agency, reach into the care and control of the life of its workers beyond the confines of the plant through the close connection that exists between the official agency and the other divisions of the health department of which it is a member.

Review in Industrial Medicine

—Harvard School of Public Health—

DURING the month of May there will be held, under the auspices of the Harvard School of Public Health, a series of clinics, lectures, and plant visits on various aspects of Industrial Medicine and Surgery. It will be possible for those attending to make reasonable changes in the schedule in order to meet individual preference. A number of vacancies in both mornings and afternoons are left to care for special clinics and special plant visits to be arranged with the applicants. Students taking Industrial Hygiene in the School of Public Health are free to take this course as their May field work. Applicants from outside the School will enroll as special students, for which the fee will be $65. Application blanks can be obtained from the Secretary.

—CECIL K. DRINKER, M.D., Dean.

Clinical Review in Industrial Medicine

May 1: DR. HENRY C. MARBLE: Mass. Gen. Hospital—fractures; clinic. P.M.—DR. ERICH LINDEMANN: Neuropsychiatric exams. Lecture and clinic.

May 2: DR. HENRY C. MARBLE: Am. Mutual Insurance—physical exams; clinic. P.M. — DR. ERICH LINDEMANN: Neuropsychiatric exams. Lecture and clinic.

May 3: DR. HENRY C. MARBLE: Mass. Gen. Hospital—fractures; clinic. P.M.—DR. ERICH LINDEMANN: Neuropsychiatric exams. Lecture and clinic.

May 6: DR. HENRY C. MARBLE: Am. Mutual Insurance—eyes; clinic. P.M.—DR. ERICH LINDEMANN: Neuropsychiatric exams. Lecture and clinic.

May 7: PROF. PHILIP DRINKER: Records of working conditions and their significance.

May 7: DR. A. R. MORITZ: Lecture on Autopsies and their medical-legal significance.

May 8: DR. HENRY C. MARBLE: Mass. Gen. Hospital—hands; clinic.

May 9: DR. HENRY C. MARBLE: Am. Mutual Insurance—back; clinic.

May 10: Industrial Accident Board of Massachusetts—hearing of cases.

May 13 and 14: Norton Co., Worcester, Mass., clinic and plant inspection. All day.

May 15 and 16: General Electric Co., West Lynn, Mass., clinic and plant inspection. All day.

May 17: Industrial Accident Board of Massachusetts—hearing of cases.

May 20: P.M.—PROF. PHILIP DRINKER: Etiology and prevention of silicosis. Lecture.

May 21: P.M.—DR. W. IRVING CLARK: Diagnosis, treatment of silicosis. Lecture.

May 22: P.M.—DR. R. Z. SCHULZ: Pathology of silicosis and asbestosis. Lecture and demonstration.

May 23: DR. C. GUY LANE: Industrial dermatoses. Lecture and clinic. P.M.—DRS. FRANCIS T. HUNTER

and G. K. Mallory: Benzol poisoning at the Mass. Gen. Hospital. Lecture and demonstration.

May 24: Dr. C. Guy Lane: Industrial dermatoses. Lecture and clinic. P.M.—Dr. J. C. Aub: Lead poisoning; radium poisoning. Lecture.

May 25 through 29: Dr. C. Guy Lane: Industrial dermatoses. Clinic.

Gangrene of a Foot

—*Following Carbon Monoxide Poisoning*—

J. Alfred Wilson, M.D.,
and
William C. Carey, M.D.,
Meriden, Connecticut

THERE are many complications of carbon monoxide poisoning which are well known, and in a review of the literature, gangrene of an extremity as a sequel is very unusual, but does occur.

McLean[1] reports a case of poisoning by burning gas containing 7% carbon monoxide, which developed gangrene in both legs. Laignel-Lavastine and Alsjouanine[2] observed a patient in whom, three weeks after acute poisoning with illuminating gas, there developed gangrene of the foot and phlegmasia alba dolens. The case ended in recovery. There are many cases cited in the literature describing the damages that occur in the nervous system. Shillito *et al.*[3] made a study of 21,143 cases of gas poisoning in New York City. Of 14,572 who recovered, they found 43 cases showing nervous and mental changes. They did not record any which developed vascular damage and gangrene. Consolidation in the right lung a few days after exposure, accompanied by fever, according to Drinker and Cannon[4,5] is a common complication.

We wish to report a case of vascular changes and gangrene of the foot appearing in a workman three months after acute carbon monoxide poisoning.

The gas used in the furnace by this patient is manufactured by the action of steam on coal, is known as "water gas," and contains about 10% carbon monoxide. It is used in the homes and factories of the city.

The patient, a man 72 years of age, had worked for 45 years hardening metal over an illuminating-gas furnace. The morning of January 9, 1936, he was working as usual in the furnace-room. Doors were closed, the sky overcast with no wind blowing, and ventilation was poor. About 10 A.M., another workman found him sitting on a chair, confused mentally and complaining of nausea. At 11 A.M., he was taken home semiconscious and in shock, but could be aroused from his stupor. Hands, forearms and feet were cyanotic, cold and clammy; blood pressure 160/60, pulse 90. Heart sounds were clear, irregular, with a few extrasystoles. The patient was surrounded by heating pads. By 4 P.M., the cyanosis of the extremities had disappeared but the mental confusion remained. Blood sugar was 170 mgm. At 7 P.M., temperature was 102°. No spectroscopic examination of the blood was made.

January 10, there was no change. Blood count showed: Hemoglobin 80%, erythrocytes 4,970,000, leucocytes 12,000, basophils 0, eosinophils 1%, juv. neutrophils 0, stab neutrophils 9.5%, seg. neutrophils 71.5%, lymphocytes 14.5%, monocytes 3.5%. Two hundred white blood cells were counted.

Consultation with Dr. Charles Solomon, January 10, 1936: "Preceding this picture, the patient had presented no marked senile mental changes. The story of exposure to carbon monoxide with extreme stupor and cyanosis of upper and lower extremities for two days thereafter, is a valid explanation for the picture as it is today. Possibility of cranio-cerebral trauma was considered and kept in mind, though no specific evidence of this was found in the present examination."

No change occurred until January 15. The tongue was very coated and there was marked tenderness over the liver. An area of ecchymosis appeared over the right mastoid. Later, this was interpreted as a Battle's sign, indicative of a fractured skull.

On January 17, signs of pathology appeared at the base of the right lung. He was given parenteral liver extract. By January 20, the white blood cells were 20,400. After a few days he recovered from the pulmonary lesion.

On January 23, Dr. Solomon saw the patient again. His impression was: "The reconstruction of the data indicates that the man of 72 years, who, before the present illness showed only slight senile mental changes, which were not even noticed by his relatives and friends, was exposed to carbon-monoxide gas. In the resulting stupor, it appears he must have struck his head and sustained a skull fracture. The gas poisoning is capable of producing the mental change noted and the cyanosis of the extremities described. The skull fracture indicates that the head injury probably also caused cerebral damage, contributing to the mental and neurological changes. The neurovascular changes causing a picture resembling Raynaud's disease occurred from carbon monoxide poisoning and is the best explanation in the light of the history of exposure."

On January 28, patient stated his right foot burned during the night. As time went on, the foot became worse—painful and colder than the left. When hung down over the side of the bed it would be very red, and when elevated it would become pale. Pulse in the ankle arteries was variable and difficult to obtain.

February 1, x-ray of the skull revealed a fracture over the parieto-occiputal region. Lungs—bronchiectatic and fibrotic changes not very marked .

During February, the involvement of the right foot became worse; colder, more cyanotic and very painful. Toward the end of the month, he was unable to walk on the foot. Pulsations of popliteal, tibial and dorsalis pedis arteries disappeared. The mental confusion was some better but still present.

Through March, the right leg continued to grow worse. Several times, the leg was injected below the knee with 40 cc. of 1/2% procaine, with no appreciable improvement in condition or pain.

April 2, a small area of gangrene developed at the base of the first and fifth toes of the right foot. April 6, it was decided to amputate the right leg. Mid-thigh amputation of the right leg was performed by Dr. H. deForest Lockwood. On April 7, temperature was 104.8°, the patient was irrational, with atelectasis of the right lower lung. He became comatose and expired on April 9.

Examination of the amputated leg — The Meriden Hospital:

Specimen: right leg—4/6/36.

GROSS: Popliteal, posterior tibial, anterior tibial and dorsalis pedis arteries are sclerotic but patent. The interosseous artery to little toe obliterated; to other toes almost obliterated.

MISROSCOPIC: Popliteal artery shows a constricted lumen due to new formation of fibrous tissue with patchy deposits of calcium, especially in the media. Elastic coat is not split. Similar changes in all arteries down to and including dorsalis pedis and interosseous which shows in addition lumen almost obliterated by new formation of fibrous tissue, upon which is layered an organized thrombus. No signs of active arteritis or periarteritis.

DIAGNOSIS: Arterial sclerosis with obliterating arteritis and thrombosis of the dorsalis pedis artery.

COMMENT: Other writers have described permanent damage to the nervous and vascular systems .

A. J. Hall[6] explained the damages to the nervous system: (a) that all the symptoms are produced by the anoxemia due to the action of the carbon monoxide on the oxyhemoglobin of the red cells with resulting deprivation of oxygen to the nervous tissue and vascular changes — hemorrhages, thrombosis and degeneration. (b) LeDosseur's theory that the carbon monoxide, having once saturated the red cells, becomes dissolved in the serum and attaches itself to the nerve cells and has a direct toxic effect on them.

SUMMARY: 1. A man 72 years of age, working over a gas furnace, hardening metal, was found in a confused mental state, suffering from acute carbon monoxide poisoning.

2. Bronchopneumonia (right) developed eight days after the injury.

3. Three months after injury, gangrene of the right foot appeared. The right foot was amputated. The patient expired four days after the operation.

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End Results Following the Nicola Operation

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Chicago

AFTER hearing comments on the Nicola operation, I am almost afraid to tell my experiences, because it seems that the classical Nicola operation really should not work. But, the results that I quote are from the fracture ward of the Cook County Hospital, and from the private cases of DRS. CUBBINS, SCUDERI, and myself. In all of these, a typical Nicola procedure has been followed.

By placing the hole through the head of the humerus on the articular surface rather than on the non-articular surface I feel that we have adequate covering and protection by the supra- and infra-spinatus tendons. These prevent lipping and slipping at the articular edge. This is not true if the hole is drilled beyond the insertion of the tendons, as in abduction the transplanted tendon is not protected and may be easily frayed.

We have 34 cases that were operated since 1933. One case was a bilateral dislocation; an orderly at the Cook County Hospital, after watching the results of some of the Nicola operations, decided to have his shoulder operated. We operated the left shoulder successfully. Later the right shoulder was operated, but he experienced weakness in the biceps muscle for about three months. This, however, cleared up, and at the present time he has full function of the right arm.

We find that the majority of cases could be split up into two groups: (1) athletes, and (2) epileptics, and there might be some relationship. In the athletic group the average age was about 27 years, and in the epileptics it varied.

There was one boy who had repeated attacks or seizures; as many as four or five a day. I did a typical Nicola operation on his shoulder. He recovered, and on return I asked him if his shoulder had ever dislocated or had caused him any trouble. His only complaint was that during the seizures his opposite shoulder came out. If one can repair a shoulder in an epileptic successfully, it should hold in an athlete.

I have a movie here that I would like to show, a typical case which was operated only two weeks ago, so I cannot give you the end result at this time. Of the 34 cases we have operated, there was one failure. In two or three cases we hesitated to do a typical Nicola operation, because of

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the size and diameter of the long head of the biceps. I would advise that if the tendon is very small, it should be reinforced with heavy braided silk, with or without the bichloride solution that Dr. Ryerson suggested. We usually use beeswax over the braided silk, as this seems to preserve the silk and prevent further irritation. The tendon may be reinforced with braided silk in order to strengthen and increase its efficiency. This eliminates the use of fascia, or other tissue.

Our one failure was in an epileptic who had numerous seizures every day. Dr. Conley later operated this case, and recent reports reveal that she has not had a recurrence of the dislocation. (A motion picture film was shown demonstrating the technique of a Nicola operation.)

After removing the skin clips, and two or three weeks have elapsed since surgery, the shoulder may then be put in abduction and external rotation for another four to six weeks. This favors repair of the supra and infraspinatus tendons, and gives a better functional shoulder.

Conclusion: I believe that our results on the 34 cases that we have operated, with only one failure, warrant the continuance of the Nicola operation for habitual dislocations.

Dr. MARCUS H. HOBART, Chicago: I think that anybody who has 34 operations with only one failure should be congratulated. Nobody can beat that except the Englishman who had 27 with no failures; and he is away across the ocean.

We have, for a long time, used plaster casts in children, athletes, and idiots. I think a plaster cast is the best thing, because many of them have to be treated so that they cannot get lose and tear out. One reason we do the combination operation is because the first fellow we did one on had tendons so tiny that we were afraid it would not hold. I think Dr. Callahan is to be congratulated on his results.

The Combination Operation for Recurrent Dislocation of the Shoulder

Marcus H. Hobart, M.D.,
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RECURRENT dislocation of the shoulder means a repeated displacement of the head of the humerus out of the glenoid fossa. Tavernier makes a distinction between habitual dislocation which occurs at the slightest provocation, and recurrent dislocation which may occur several times, but only as a rule with severe trauma. In the former type operative treatment is more imperative than in the latter.

Etiology usually includes some form of severe trauma and, therefore, occurs more frequently in those exposed to violence. Most authorities consider that the dislocation is brought about by abduction of the arm, but Bankhart, a British author, considers that it occurs from direct trauma to the back of the shoulder. I have found no evidence in the literature of anyone agreeing with him.

Predisposing causes are listed as:

1. Defect in the head of the humerus acquired at the first dislocation or congenital.
2. Defect of the glenoid, acquired with fracture of its edge, or congenital shallowness.
3. Rupture of insertions of external rotators of the head of the humerus.
4. Avulsion of the tuberosities with or without the preceding.
5. Detachment of capsule from anterior lip of glenoid.
6. Enlarged joint from relaxed capsule from tears with insufficient time for cicatrization, or repeated stretching without tears.
7. Failure of neuromuscular coordination.
8. Shearing off of anterior fibrous or fibro-cartilaginous ligament from its attachment to the bone at the glenoid fossa, by a force from behind is Bankhart's opinion of the cause.

In discussing the subject of the choice of operation, many considerations are of importance. It is granted that the patients require an operation to prevent recurrence, as no apparatus is satisfactory or sure. The simple method of fastening the elbow to the belt by a chain in most cases will prevent dislocation, but such a method is not satisfactory. We have used it for athletes during a football season. I have employed a leather shoulder guard which is less conspicuous, but at the same time not certain.

Therefore, some form of operation is indicated in these cases. Last summer at the request of Dr. Fred Albee, of New York City, I reviewed this subject for a symposium on Traumatic and Industrial Surgery.[1] In this review the operations were classified more or less anatomically:

1. Operations on the bony structures.
   (a) Deepening of the glenoid from behind (Hildebrand).
   (b) Bone graft at margin of glenoid (Eden, Speed).
2. Operations on the capsule.
   (a) Anterior capsulorrhaphy (Ricard, Henderson, Albee, MacAusland).
   (b) Capsule repair (Bankhart).
3. Muscle transference and muscle lengthening (Clairmont, Ryerson).
4. Suspension operations (Spitzy, Carrell, Henderson, Fowler).
5. Biceps tendon operation (Nicola, Roberts quoted by Burnet).
6. Combination operation (Hobart).

In an effort to ascertain the value of the Nicola operation in these cases, I corresponded with many of the prominent surgeons, both in Chicago and elsewhere, who had reported Nicola operations they had done. The results showed that nearly all had had recurrences after this operation in some cases, and this included one of my own. In other words, the Nicola operation, al-

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though an excellent one in most cases, will allow recurrences even when done by experts. And when subjected to severe trauma it is reasonable to believe that more will not hold. This last summer I saw a case in point. The patient was on the All-Star football squad, whose injuries I have taken care of from the first. He had had a Nicola operation done for recurrent dislocation by a well-known surgeon in Iowa. During practice with the All-Stars he had the shoulder dislocated again, so that it was necessary for it to be reduced. This injury of course kept him out of the All-Star game and probably would interfere with his playing professional ball this fall if he wanted to. Financially as well as otherwise this would make a big difference to him no doubt.

On the other hand, a great many have been operated by the Nicola and have played football, handball, hockey and tennis without trouble. The statistics are as reviewed last summer: 278 recurrent dislocations operated upon as follows: 132 Nicolas with eight recurrences; 41 teno-suspensions with one recurrence; 17 fascia suspensions with no recurrence; nine burying tendon in a deepened bicipital groove without recurrence; 27 anterior capsule repairs without recurrence; two combination operations without recurrence; 43 muscle suspension operations with 14 recurrences.

Well, if the Nicola operation will not hold all these shoulders in, and it will not, what operation will? It is not certain that any operation will, but there are other ones that have in a limited number of cases. What we call the combination operation has worked to date. Other surgeons, including Dr. Carrell and Dr. Henderson, have devised special operations. Many of these operations will work well in the hands of their authors, but most of them are quite intricate and require a good deal of technical skill, especially devised instruments, and comprehensive knowledge. Certainly no operation about the shoulder should be undertaken lightly or done by a novice. I think that all of them are hard to do, including my own.

This "combination operation" as the name implies is not a new or original operation, but it is an original combination of other operations. Zinc and copper have existed separately for years before someone combined them to make bronze. This operation takes advantage of the fact that the Nicola operation and the Clairmont operation can both be done on the same shoulder without interfering with each other. Dr. Ryerson and others have done the old Clairmont operation with success in most cases. Many have done the Nicola with similar results. So the combination should insure success. I say it should because my experience with this method has been very limited and I would like to do many more before I feel certain about it. The first ones, however, have worked and stood the test of hard football and basketball and lasted for five years so I have hopes about future ones. When someone has proved a better operation, I shall be happy to take it up, since this operation, because it is really two distinct operations, takes a long time to do.

The technique is simply to perform a Nicola operation first with the patient prone, and then prop up the shoulder and do the Clairmont operation from behind. The technique is as follows:

Under ether anesthesia, a modified Nicola operation is done. With the patient on his back and the forearm flexed and pointing forward, an incision is made about ½ inch posterior to the anterior border of the deltoid muscle, thus avoiding injury to the cephalic vein and allowing exposure of the bicipital groove and long tendon of the biceps, without cutting any of the muscle fibers. In an adult, this incision would be about 6 inches long. A fine black silk suture is placed through the biceps tendon, near its distal end, and the tendon is divided proximal to this suture, either obliquely or by a Z-shaped cut. A second black silk suture is placed through the cut distal end of the proximal piece of the tendon, and the ends of the suture are left long. With a ¼-inch drill, a tunnel about 2 inches in length is made underneath the bed of the biceps tendon. This tunnel is directed obliquely and so placed that the proximal aperture is at the junction of the cartilaginous edge of the head of the humerus and the proximal end of the bicipital groove. This allows the long tendon of the biceps to be placed through the tunnel in an anatomic and physiologic direction, avoids any sharp angle in the tendon, and obviates crushing of the tendon between the head of the humerus and the glenoid fossa.

Next, the sutures in the proximal end of the biceps are threaded through the eye of a blunt probe. The probe is passed through the tunnel, drawing the sutures and the tendon gently through after it. The long tendon of the biceps muscle is sutured together carefully. The wound is closed temporarily with a towel clip.

The second step consists of a Clairmont operation. With the patient propped up on a large sand bag, an incision is made along the posterior edge of the deltoid muscle. A strip of that muscle is separated about an inch anterior to the posterior border and freed from its attachment to the deltoid tubercle on the humerus. This strip of muscle is then passed through the quadrilateral space (care should be taken to avoid injuring the posterior circumflex artery and nerve) under the surgical neck of the humerus and fastened to the anterior border of the deltoid with sutures. (Greater security might be insured in this part of the operation if the strip of deltoid muscle were fastened to the coracoid process.)

The skin incisions are closed and a Velpeau bandage applied. A cast is then worn for three weeks. Motion is gradually resumed, with careful physiotherapy. The patient can return to full duty in from two to three months.

Discussion

DR. EDWIN W. RYERSON, Chicago: The original Clairmont operation is anatomically correct, and it is a little difficult to do. It takes more time than the Nicola and I have only done 10 cases by that method, but none of them, so far as I know, has had a recurrence. I

think the reason some of Clairmont's and Ehrlich's cases did recur was because they sewed the end of the deltoid muscle to the deltoid itself, which does not give it a very secure fastening; whereas if it is sewed to the coracoid process with silk boiled in paraffin, being fastened either by itself or through the intervening silk to the coracoid process, it makes a very secure attachment.

The operation takes quite a little time, and I switched to the Nicola operation, but have had one partial failure which may be due to the fact that the hole was made through the head of the humerus and through the cartilaginous part of the head where it is subjected to a certain amount of friction and traumatism, and it is quite possible that it caused degeneration and loosening.

I think this operation is therefore very ingenious and very useful.

DR. JAMES A. VALENTINE, Chicago: What is Dr. Hobart's opinion of the operation described by Fowler of the removal of the bicipital groove and turning it upside down?

DR. MARCUS H. HOBART: The first Nicola that we did was according to Nicola's original technique and it was a failure, perhaps for the same reason that we changed the technique. Dr. Fowler's operation we have had no experience with, but I know that Dr. Fowler is a good man and if he says his operation is good, it must be so. It sounds very logical to get the long head of the biceps to hold the humerus in place. Anything that will make the long head of the biceps stick to the head and hold it there should work, and his operation would also seem more simple.

The hardest part of the Nicola operation is to induce that long head of the biceps to come through the canal, and by lifting the roof of the groove off and putting the tendon through there, he has done a more neat job. Robert's operation is just as simple as that. He makes the groove and puts the tendon in the groove, and I believe does not cover it with bone.

Air Hygiene Meeting

PROFESSOR PHILIP DRINKER, in rendering the Report of the Preventive Engineering Committee, mentioned that for the last three years, Air Hygiene Foundation has rendered generous help to the *Journal of Industrial Hygiene and Toxicology* in the form of an annual gift which has helped defray the cost of publishing the Journal's abstracts of the world's literature on industrial hygiene.

In 1938, the Foundation established two fellowships at the Harvard School of Public Health. At present, these are held by two engineers working towards the Doctorate of Science degree in Industrial Sanitation. The thesis work of these men is directed towards problems of direct interest to Foundation members.

An important problem in silicosis prevention and in the appraisal of silicosis risks is, "What is the most potent size of silica particles?" It is recognized that the most dangerous sizes are certainly below 3 microns, (a micron is 1/25,000 of an inch) but whether there are critical differ- fractions, 3.30, 1.65, 1.04, and 0.62 microns, and the fractions cleared, as far as possible from particles other than the above. Sterile suspensions of these fractions were then injected into the ear veins of rabbits twice at three-month intervals and the animals killed and autopsied periodically.

Preliminary examination of liver sections indicate that the fine particles are more rapidly taking up by cells than are the larger ones. Later examinations showed no striking effects with the two larger sizes (3.30 and 1.65 microns), while it looks as if the third and fourth (1.04 and 0.62 microns) produced the greatest changes. The final report on this will be ready in about eight months. The reason engineers want the information which it is hoped this study will bring is that they are responsible for measuring degrees of dustiness in workplaces and for controlling conditions. Also, they must design dust respirators. They would like to know what, physiologically, are the most important sized particles and then they can focus thier efforts particularly against them.

An engineering corollary to this problem is: "What is the most difficult size dust particle to wet when floating in air?" and: "What can be done to make the modern air washer into a more efficient dust catcher?" These questions are important to the air-conditioning industry, and to all plants where air is cleaned by wet methods. The graduate student who is working on the dust injections is studying commercial air washers with a particular view to the possible application of wetting agents (surface active agents). An incentive to the study of this problem has been the remarkable progress recently in the separation of non-metallic dusts by flotation, a method thought inapplicable to industry a few years ago.

As evidenced by the number of papers published in the last year, interest in the vapors from organic compounds has become widespread. Firms selling equipment or materials in which such solvents are in any way concerned are generally alert to the problem. Methods for detecting and for recording such substances are being reported from numerous laboratories. At least three large firms have arrangements for investigating the potential risks of one new compound after another and thus to determine under what conditions they can be marketed and used safely. As compared with the silicosis field, it is likely that the interest and activity in these directions will increase rather than diminish as new compounds continually are being developed.

The design of electroplating tanks, baths, and vats using toxic solvents and liquids has not yet been placed on a rational basis. The purpose of the second Foundation research now in progress at Harvard is to investigate the characteristics of these solvent tanks and to provide a rational basis of design by studying their performance under various conditions.

Small tanks, with lateral exhaust on one or two sides, have been used. Taking several liquids with widely different physical properties, trichlorethylene, water, toluol, triethylene glycol, the minimum ventilation requirements at various temperatures

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and evaporative rates have been determined. This phase of the work is now nearing completion.

With reasonable surety it may be stated that the required ventilation in CFM (cubic feet per minute) varies as the evaporative rate to an exponent. The use of a minimum quantity, rather than a minimum velocity, has been found necessary in the case of fumes, vapors, and mists, and it is believed this work gives adequate basis to that fact.

The second phase of the work has been to ascertain the velocity characteristics of these tanks. The velocities at all four tank corners and at the sampling point are being determined to find which location will give the best and most satisfactory correlation with vapor concentration.

In addition to the above work, a new vapor-pressure instrument for determining organic solvents in air has been developed. Also, a new dust-counting instrument revision was made.

The development of instruments for recording continuously low concentrations of toxic vapors should interest the members of this Foundation. Many firms using toxic solvents must either continue to use them or else take up an entirely new line of manufacture—often they cannot use harmless substitutes. Under such conditions, the plant management requires periodic sampling of the air to find out if ventilation is as it should be.

Recorders are available today for carbon monoxide, sulphur dioxide, carbon disulphide, mercury vapor, and carbon dioxide, while continuous alarms or detectors for inflammable gas mixtures are in fairly general use. Smoke recorders are common in general power plant practice. It is well within the realm of practical matters to develop instruments which will furnish reliable records, 24 hours a day, of air pollution from low concentrations of substances, such as benzol or carbon tetrachloride. There is every intention of pursuing the problem further n the work for the Foundation at Harvard.

As a result of DR. L. U. GARDNER'S medical research, backed by many field studies by others, notably the United States Public Health Service, it is now possible to outline and carry out, with reasonable assurance, a reasonable dust-control program. Industry neither demands nor expects from experimental medicine great precision in these matters, such as toxic limits in air. In the field of silicosis they have very nearly got what they need and certainly they now know very clearly how many missing gaps can be filled out.

It is of some interest that the use of aluminum dust in the treatment of men who have had exposures to silicotic dust has definitely been suggested at least twice; once, to an important mining group, and again to the granite cutters' union. Furthermore, patents on the use of aluminum dust, both for the prevention and for the treatment of silicosis, have been granted.

What place, if any, the use of aluminum or other protector dusts may eventually have in silicosis control remains to be seen. In the meantime, we see no reason to reduce either engineering or medical control in any way whatever.

DR. LEROY U. GARDNER summarized the activities regarding the Foundation research at Saranac Laboratory. The department of petrography established at the Saranac Laboratory under a grant from the Air Hygiene Foundation has contributed materially to its program of industrial investigation and laboratory research. The petrographer has classified some 150 samples of rock for 14 different industries and thereby contributed necessary information in the evaluation of dust hazards. He has been most helpful in the analysis of minerals recovered from the lungs of persons dying with various forms of pneumoconiosis, particularly in those where obvious silicosis exists with no record of an exposure to free silica. He has supervised the preparation of 50 different minerals that have been subjected to animal tests, verifying their composition, checking the particle size and other physical properties.

Free silica (quartz), if breathed in sufficiently high concentration over a period of years, is responsible for the lung disease silicosis. Only very fine particles can enter the lung, particles measured in terms of a few microns. While human lungs contain particles as large as 10 microns in largest dimension, evidence suggests that they and others above 3, or, perhaps, 4 microns can be disregarded in evaluating a silicosis hazard from quartz. Animals infected with low virulent tubercle bacilli do not develop progressive tuberculosis when injected with quartz particles larger than 3 microns.

A study has just been completed of the relative settling rates of unit-sized particles of different minerals and mixtures of minerals. It is demonstrated that, with particles 3 microns and less in diameter, factors other than specific gravity govern their settling rate in air. Of many minerals investigated, quartz and sericite remain suspended longer than any others. This differential settling emphasizes the importance of taking dust samples in the workman's breathing zone to determine the extent of the hazard to which he may be exposed.

Experiments with pneumococcus infection in rabbits having silicosis demonstrate that the pneumococcus does not find silicotic soil particularly favorable for its growth. Type III pneumococcus pneumonias, artificially produced in silicotic rabbits, run a normal course. The presence of advanced silicosis has no influence upon the well defined immune reactions to this organism which can be elicited in normal rabbits by subcutaneous injections. These observations confirm the growing clinical impression that lobar pneumococcus pneumonias are no more common in silicotic subjects than in normal ones and that their course is not unfavorably influenced. Further work is needed on the non-specific bronchopneumonias caused by other bacteria.

Another important group of experiments has been started to determine whether individual susceptibility to silica dust is acquired or whether it is due to innate peculiarities of different individuals. The desirability of detecting susceptible subjects in pre-employment physical examinations is obvious.

Pneumonia in Industry

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DR. HAVEN EMERSON, one of America's foremost industrial hygienists, has stated that with advancing civilization and industrialization man is surrounding himself with ever increasing health hazards. This fact is now well recognized in so far as it concerns health hazards of the employee during his working day at his specific occupation, such as those involving dust hazards, industrial poisons, and sanitation. One might question, however, whether the general health and resistance of the employee is receiving the attention it justly deserves. What about his exposure to temperature extremes, inclement weather, and rarified atmosphere? What about his shelter, food, and relaxation during the 14 to 16 hours of the day when he is not performing his one particular job. Do not all of these factors enter into the problem of helping the employee by healthy, happy, and efficient 24 hours of his daily life?

Let us consider the pneumonia problem and the part it plays in the life and death of the industrial worker. Pneumonia is most commonly a disease of middle age. Its course is short and vicious, and it kills at least one out of every four persons who are not specifically treated. Being a disease of middle age, it falls upon the economically important age group, the people who are supporting their families, the communities in which they live, and the industry in which they are employed. Upon the shoulders of these people lies the whole burden of our economic and social structure.

There is a striking contrast between the death rate from pneumonia and that from other definite occupational diseases. For example, during the three years between August 30, 1936 and October 1, 1939 only 23 death claims have been filed before the Illinois Industrial Commission as a result of silicosis, lead poisoning, gas poisoning, etc. During the past 20 years, between 5000 and 7000 people every year have lost their lives from pneumonia. Of course, all of these were not industrial workers, but at least 50% of them are of the employable age group. Approximately 40% of all people gainfully employed in Illinois are engaged in the manufacturing and mechanical industries. This means that approximately 1500 people in industry lose their lives each year in Illinois from pneumonia.

Perhaps we cannot classify pneumonia as an occupational disease. Perhaps industry cannot be held strictly responsible for the health of its worker away from his occupation. But we cannot deny the fact that pneumonia is a striking industrial health problem from the standpoint of the general welfare of the worker.

If we broaden the statistical definition of occupational diseases to include not only those which occur only in relation to a specific occupation, but also those which occur in higher percentages of workers performing this occupation than in the normal population as a whole, there are definite industries in which pneumonia must be considered an occupational disease.

A very complete report of pneumonia morbidity and mortality was published by the United States Public Health Service in 1932, following a survey among iron and steel workers. The figures are revealing.

Iron and steel workers are constantly exposed to intermittent extremes of temperature, unsheltered work, and humid and drafty conditions. The average frequency of pneumonia in occupations involving exposure to inclement weather was 13.6 cases per 1,000 men. The case rate among men subjected solely to hazards involving wide ranges of temperatures was 12.6 per 1,000 men. These rates may be contrasted with the frequency of 3.9 cases annually per 1,000 factory men exposed to no industrial condition which might be regarded as particularly hazardous from a pneumonia standpoint.

The report further shows that iron and steel workers who have recovered from pneumonia exhibited a higher rate of heart defect than cases found in a whole group in the same plant. Considering the number of men employed in blast furnaces, steel works, and rolling mills in the United States, one may estimate that the cases of pneumonia in excess of those experienced by an equal number of men in other industries are about 685 per year, and the number of excess deaths about 171 per year. Few diseases of occupation cause as many serious illnesses and such great destruction of life.

Many are the industries outside of iron and steel in which the employees are exposed to inclement weather, humidity, drafts, and temperature extremes—construction work of all types; packing house employees; foundry workers; moulders; and platers—to name only a few. For instance, during the years 1930 to 1937 pneumonia was the second most common cause of death among workers in the Portland Cement Association.

Such is the pneumonia problem as it appears to industry, both to the general health of all workers and to specific occupation. What steps, therefore, should be taken by industrial physicians and nurses to meet such a problem?

TWO factors must be present in order for a person to develop pneumonia. First, the pneumococcus or other causative organism must be present in the nasal passage or throat of the individual. Second, the tissue resistance of the individual must be lowered, either generally or locally, so that the pneumococcus may invade the lung. Factors concerned in the general lowering of tissue resistance are those that we have previously named, such as exposure, dampness, and chilling. Others are alcoholism, postoperative states, malnutrition, and fatigue.

The first step in the control of any disease is its

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prevention, and the most effective preventative measure known is vaccination. Unfortunately, as yet we are unable to vaccinate or immunize an individual against the invasion of the pneumococcus, but we do know enough about the infectious nature and epidemiology of pneumonia to be able to control the invasion by cooperative and concentrated efforts. We are now considering pneumonia a Public Health problem, and as such, our aim is its prevention—which should be the aim of all medical effort.

Although we cannot actually prevent pneumonia, we are able to do something about the predisposing factors which are necessary for its onset. Unfortunately, industry furnishes all common predisposing factors, such as:

1. Lowered resistance—by exposure, temperature changes, etc.
2. Chilling and wet feet.
3. Close contact with fellow workmen who may be coughing and sneezing.
4. Inhaling of chemicals and fumes which may interfere with ciliary activity.
5. Fatigue.
6. Trauma which is related indirectly to pneumonia—especially by chest injuries.
7. Postoperative pneumonias which follow accidents and surgical treatment.

To eliminate the factor of lowered resistance due to exposure, chilling, dampness, and temperature extremes, the worker should be constantly reminded of his general health so that it can be kept on as high a plane as possible. Working conditions should be adjusted so as to obviate as far as possible the exposure factors.

Also, much can be done by education of the employee. In general, he does not realize the importance of such seemingly minor details as changing clothes while standing in a draft, or going home from work without changing from the sweat saturated work clothes into dry ones. These factors can be eliminated only by education of both the employer and the employee.

After general resistance, the next most important factor is lowered local tissue resistance either as it applies to inhaling of chemicals and fumes which may interfere with ciliary activity or more commonly, to upper respiratory infections with inflammation and edema of the mucous membranes. In the pneumonia carrier, a common cold is all that is necessary to bring about lung invasion. Seventy-five per cent of all pneumococcic pneumonias are preceeded by an upper respiratory infection. Eighty per cent of the general population have at least one cold per year, and of this 80%, approximately 60% have from two to five attacks yearly. The greatest opposition met in an attempt to control this situation is public opinion because it is the common belief that colds must be expected during certain seasons, that there is little to be done about them, and that home remedies are sufficient as therapeutic agents.

If we are ever to control pneumonia, we must control upper respiratory infections. In order to do this, the public must be made to realize that colds are serious and should be treated by complete bed rest, and expert medical attention. The common cold is contagious and a person who is isolated protects not only himself but others as well. Close contact with fellow workmen, which occurs under existing industrial conditions, is a fertile field for the spread of respiratory diseases.

After prevention, the next most important step in pneumonia control is making an early diagnosis. We now have at our disposal two potent therapeutic weapons for treating pneumonia — antipneumococcic serum and sulfapyridine. These are most effective, however, when used early in the course of the disease. For this reason, the patient must call in medical aid immediately, and physicians and nurses must readily recognize the disease. The onset of pneumonia is more often than not atypical. It is likely not to strike suddenly with severe chills, pain in the chest, and a cough with rusty sputum. Its onset may be insidious, and may simulate the onset of other pulmonary diseases or any acute infection. A bad cold which seems a little worse and fails to abate may be the only early clinical sign. Physical examination as well as x-ray examination may be entirely negative. Under these conditions the only way a diagnosis can be made is by exclusion, and by sending a sample of sputum to the laboratory for examination and typing of causative organisms.

If the diagnosis of pneumonia is made or even suspected, it should be realized that a medical emergency exists, time is an important factor, and active treatment must be instituted at once.

All pneumonia cases should be hospitalized as soon as possible, for only in a well equipped hospital is it possible to have available at all times the equipment and facilities necessary for the proper care of the pneumonia patient. Here he can be properly isolated and surrounded by the atmosphere of rest and comfort that is so necessary for his recovery. Here he can obtain the skilled nursing and constant medical supervision that he needs during the most acute phase of his illness. Here also, is available oxygen, intravenous fluid, and other measures that might be necessary at a minutes notice. Laboratory service is immediately available. Whether sulfapyridine, antipneumococcic serum or both are administered to the patient—they should always be given under the constant watchful eye of the physician and nurse, and with proper laboratory control.

These are the ideals that we are now striving for. Pneumonia is a serious disease with many complications, and will always have to be treated expertly and conscientiously. It will never be treated out of a "pill box," no matter how simply treatment is pictured by popular lay articles.

You, as industrial nurses and hygienists, are frequently the first people to come into contact with early cases of pneumonia. It is up to you to develop a pneumonia conscience, to suspect it in spite of its various clinical pictures, and to see that proper medical attention and hospitalization are acquired for the patient. You can also do your share in the education of the employee to help

make him realize not only the seriousness of pneumonia but the seriousness of an upper respiratory disease as well.

Last year, by making Illinois physicians pneumonia conscious and distributing free antipneumococcic serum for the most prevalent types, we were able to reduce pneumonia mortality in serum treated cases by 37.6%. Last year the death rate from pneumonia was less than any previous year in the history of the Department of Public Health, although the case rate was comparable. We like to feel that just a little education did this. With the means that we now have at our disposal for combating this disease, there is no reason why pneumonia mortality should not be cut to half, and at least 2,000 important lives saved each year in Illinois.

Trauma

—*In Relation to Multiple Sclerosis*—

E. D. FRIEDMAN, M.D.,
Professor of Neurology, New York University College of Medicine

TRAUMA has been considered an etiological factor in many forms of neural illness, including multiple sclerosis. Kurt Mendel maintained that one might postulate a relationship between multiple sclerosis and trauma if the following facts could be established: (1) direct injury to the bony spine; (2) exclusion of other causes of neural illness; (3) complete freedom from disease prior to the trauma; (4) a reasonable interval between the appearance of symptoms and the injury—this might vary from a few weeks to several months or possibly one year (not five years).

Statistical studies by Berger, Marburg, Jelliffe, and others show the incidence of trauma in 8 to 10% of the cases of multiple sclerosis. Our own experiences seem to confirm this percentage incidence.

General Considerations

INJURY may be evaluated, in industrial medicine, at least as an aggravating or precipitating factor. Then, whether prodromal symptoms were present or not, one would have to say that, in spite of the possibility of spontaneous progression, trauma must be taken into consideration as an exacerbating factor, especially when gross aggravation of symptoms occurs soon after receipt of the injury or when symptoms localize themselves at the site of the trauma. One must bear in mind that acute pareses have occurred after severe physical exertion, such as dancing, long marches, or exposure to freezing temperature.

Those authors who, like Strumpell, believe that multiple sclerosis is an endogenous disease, feel that trauma can only serve as a precipitating or aggravating factor. Those, however, who believe that it is exogenous (Redlich, Marie, Gowers, Oppenheim) and that intoxication, infection, and exposure to cold alone may give rise to the symptoms of multiple sclerosis, consider the possibility of trauma as a direct etiological factor.

Concerning the manner in which trauma leads to sclerotic areas in the nervous system, little is known. The possibility of necrobiosis associated with inflammatory lesions and secondary sclerosis has been considered, but a satisfying explanation has not really been given. It is important to recall that Leube who published the first case of multiple sclerosis following trauma (1871) stated simply that the injured person traced his disability to the trauma.

In most of the published cases the traumatic incident consisted of concussion of the spine, either by fall from a horse, fall on the back, fall from a ladder, fall on the buttocks, and severe concussion of the whole body. Severe injuries to the skull may also serve as etiological factors. The combination of physical trauma and exposure to cold seems to be a particularly important factor in the aggravation of symptoms.

Historical Review

MARBURG cited the case of a woman who sustained a fracture of the pelvis and several months later developed the signs of multiple sclerosis. There was no history of preceding symptoms. Sternberg and Groszman reported a case in which, two days following an injury, there was found the full-blown picture of multiple sclerosis (bilateral optic atrophy, nystagmus, intention tremor, and forced laughing). The patient had been working for one year prior to this injury and had also spent four weeks in army maneuvers, apparently without any symptoms of illness. This army service may have served as a precipitating factor in the illness.

In this connection it is worth noting that Stiefler reported the appearance of multiple sclerosis in soldiers incidental to their military training. It was his opinion that traumata involved in military training did not serve as etiological factors in the illness but rather as provocative agents, making manifest a latent illness. This is in accord with our own view.

Mayor also observed 11 soldiers in whom multiple sclerosis appeared during the war. Curschman found cases with leg signs in soldiers who were in active training (wear and tear theory of Edinger). In these cases the lateral and posterior columns were chiefly involved. Infectious disease may have played an added role in some of these cases. The belief in the acute aggravation of multiple sclerosis in soliders seems to be generally accepted. In cases that came to post-mortem examination, old lesions were found in addition to fresh foci of disease.

Monckemuller and Lowenstein, however, deny any relationship between trauma and multiple sclerosis. S. A. K. Wilson also disputed the relationship with regard to genesis but admitted the factor of aggravation. Guillain believes that trauma can only aggravate the condition. Stief-

Read in abstract before the ASSOCIATION FOR THE ADVANCEMENT OF INDUSTRIAL MEDICINE AND SURGERY, New York, N. Y.

ler, Riese, Schnitzer and Jolly also admit the role of trauma in the aggravation of symptoms. Stern denies the traumatic genesis of the disease but leaves open the question of aggravation by accident or heavy work.

Drobnes studied 103 cases of multiple sclerosis. In 11 there was a history of trauma, but only one case met the Mendel prerequisite, namely, the absence of antecedent symptoms or signs. In all cases of neural illness one is apt to seek a cause for the symptoms, hence the possible over-estimation of mild traumata. It must be remembered also that symptoms antedating the injury may be either forgotten or denied. Trauma may even have been the result of preexisting disease. Drobnes concludes, however, that traumatic aggravation of antecedent illness must be admitted.

Marburg acknowledges aggravation by trauma, and stresses the progression of symptoms, especially in individuals with an active course of the illness, following injury. In a study of 152 cases, he found 12 with a history of physical trauma and three with a history of psychic trauma. In the cases of psychic trauma, he believes, the vasomotor disturbances may have been aggravating factors. In the cases with somatic or physical trauma, vascular changes also may play a role in an individual, with a predisposed or sensitized nervous system. Both Oppenheim and Jelliffe believe that psychic trauma may aggravate multiple sclerosis via its effect on the blood vessels.

In one instance, mentioned by Marburg, the patient suffered from diplopia one year prior to the accident. In a second case, the patient had been treated by him 12 years previously but in the interval had had a fairly complete remission; the trauma then interrupted this remission. It is therefore his belief that trauma may be considered a factor, if the onset or the aggravation of symptoms occurs soon after an accident.

With regard to the possible primary incidence of multiple sclerosis in the wake of trauma, Marburg stresses the relationship between the lesions of multiple sclerosis and those described by Finkelnburg and Oppenheim as myelitic foci following gunshot injuries to the cord. Such myelitic foci could possibly serve as the basis for the later development of multiple sclerosis.

According to E. Muller, psychic and especially physical trauma may be considered etiological factors. Not infrequently, psychic trauma exercises an unfavorable influence on multiple sclerosis and the first outspoken symptoms of disease may develop directly after severe shock. Physical trauma, including electric shock from lightning, cannot however be considered the sole cause of multiple sclerosis, although Westphal reported a case which followed a stroke of lightning. It is simply, on occasion, an important accessory factor.

Diagnostic Considerations

IN THE experimental animal, no one has ever been able to produce multiple sclerosis as a result of trauma. Tracy Putnam obtained lesions resembling multiple sclerosis in the experimental animal, through the injection of tetanus antitoxin and oil. The lesions were mostly perivenous and were probably the result of stasis from asphyxia.

It is important also to remember that subjective well-being does not exclude the presence of symptomless illness. Objective signs of disease, such as changes in the eye grounds or reflexes may be found in such cases.

Strumpell stressed the importance of diplopia in the early history of cases of multiple sclerosis. Such episodes are frequently forgotten by the patient but they are significant as indicating the early stages of the illness. New symptoms may make their appearance after many years of apparent good health. I recall such instances in my own practice. One was a lady of 54 who presented the signs of pure pyramidal tract disease and normal serological findings. On closer questioning, she gave a history of diplopia 18 or 20 years previously, thus establishing the diagnosis of multiple sclerosis.

According to Schuster, the disability and symptoms should not be present immediately or a few days after the inujry, but a period of at least four to six weeks must have elapsed. Mendel, however, thought that a latent period of a few days was sufficient to permit one to postulate an etiological relationship between trauma and symptoms.

It would seem from all the available evidence that the traumatic genesis of multiple sclerosis must, in the main, be denied. Whether multiple sclerosis can be roused out of its latency by trauma is still debatable, but most authors agree that this must be admitted. This is especially true of the progressive forms of multiple sclerosis; these are undoubtedly aggravated by trauma.

That thermic trauma, especially exposure to cold, may be a factor has already been stated. Exposure to cold affects the blood vessels—hence the relationship can probably be explained on a vascular basis.

Forced faradization, carried out to differentiate between multiple sclerosis and hysteria, has led to the aggravation of symptoms.

Author's Experiences

MY OWN experiences are substantially in accord with those in the literature. Out of 61 cases studied, six gave a history of trauma. I, too, am inclined to doubt the role of trauma in the genesis of multiple sclerosis, but am firmly convinced that an adequate trauma can serve as a precipitating or aggravating factor in cases of latent or preexisting multiple sclerosis. I shall cite three cases.

CASE 1: A 32 year old rooky, who had been in training for the police force for about six weeks. During the course of his training he received a number of injuries. At the end of this period, although he had been in perfect health all his life, he rapidly developed all the signs of a classical multiple sclerosis.

CASE 2: A 30 year old housewife, who had been perfectly well. On August 31, 1934, she was re-

turning by train to her home. The train was in a collision. The patient who had been sitting on an aisle seat was thrown forward violently and landed on her buttocks. She was dazed for a minute or two. There was no injury to the head but she suffered from bruises and contusions, especially of the right leg. She was taken home about an hour later and remained in bed for four or five days. She then consulted her physician who treated her for "nerves." Several weeks later she began to have electric shocks ("pins and needles" feeling), first in the right leg and later in the left. These paraesthesias then spread to the arms and fingers. About two weeks later, she noted blurring of vision in the right eye. The difficulty grew worse. She then consulted an ophthalmologist who found evidence of retrobulbar neuritis and advised neurological examination. The patient was given a series of injections of typhoid vaccine; the ocular symptoms improved. She felt well for several weeks.

On December 12, 1934, she consulted me. Her complaints were as follows: Early in November, two months following the accident, she noticed that her legs began to get numb. She felt as though she were walking on cushions. She also experienced a little difficulty in starting the urinary stream.

Neural examination revealed the following: The deep reflexes were hyperactive but there were no frank pyramidal tract signs. There was a vague level at L-2, below which pain and temperature sense were diminished; there was a loss of vibratory sense up to the costal arch. The subsequent course of her illness showed alternate remission and exacerbation of symptoms. In a later episode she showed posterior column signs referable to both upper and lower extremities (impairment of position sense of the toes and fingers, tabetic athetosis, difficulty with stereognosis, and ataxia). The most recent examination showed a little pallor of the discs, diminution of the upper abdominals, and impairment of vibration sense in the lower limbs.

Comment: These cases apparently fulfill the Mendel requirements but cannot be offered as definite evidence of the traumatic genesis of multiple sclerosis. Here, too, the trauma probably served simply as a precipitating factor.

Case 3. A 40 year old telephone lineman, presented a history of disability coming on after a fall and exposure to freezing temperature in January, 1934. His condition was characterized by pain, weakness and stiffness in the legs and to some extent in the arms. The disability progressed up to the summer of 1936 and since then has been stationary.

Neural examination revealed evidence of disseminated lesions in the nervous system. The principal disturbances, however, were referable to the dorsal and lateral columns. A probable retrobulbar neuritis occurring in 1910 (24 years previously) was suggestive evidence that the whole syndrome was due to multiple sclerosis. There was also a history of occasional urgency of urination antedating the accident.

Comment: The present episode of neural illness was probably brought on by the accident and disturbed the long remission in his clinical syndrome.

Conclusion

ON THE basis of a survey of the literature and our own experiences, it would seem that, at the present time, there is no absolute warrant for the belief that multiple sclerosis can arise as a result of trauma per se. But there seems, in general, to be little doubt that trauma plays an important role as a precipitating factor in latent disease and as an aggravating factor in disease already present.

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Michigan Society Meeting

THE Michigan Society of Industrial Physicians and Surgeons will hold its annual meeting in Grand Rapids, Michigan, on April 17, 1940.

The meeting will begin with a luncheon at 12:00 Noon at the Pantlind Hotel.

The following program has been arranged:

1:00 P.M.—"Silicosis—Wisconsin Plan" — Elston L. Belknap, M.D., Milwaukee, Wisconsin.

2:00 P.M.—"Injection Treatment of Hernia"—Frederick W. Slobe, M.D., Chicago, Illinois.

2:45 P.M.—"Operative Treatment of Hernia"—Chester McVay, M.D., University of Michigan.

3:30 P.M.—"Nerve Injuries"—E. S. Gurdjian, M.D., Detroit.

4:30 P.M.—"Integration of Industrial Medicine with Hygiene"—Kenneth E. Markuson, M.D., Director, Bureau of Industrial Hygiene, Mich. Dept. of Health.

5:00 P.M.—Business Session. 5:30 P.M.—Social Hour.

6:30 P.M.—Annual Dinner:
President's address—Robert H. Denham, M.D.
"Low Back Pain"—Paul Magnuson, M.D., Associate Professor of Surgery, Northwestern University Medical School, Chicago, Illinois.

June Meetings

FOLLOWING is the Program of the four-day joint meeting of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS and the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION, to be held at Hotel Pennsylvania, New York City, June 4, 5, 6, and 7, 1940.

This meeting comprises the Twenty-Fifth Annual Meeting of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, and the First Annual Meeting of the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION.

American Industrial Hygiene Association

FIRST ANNUAL MEETING

Hotel Pennsylvania, New York City,

June 4 - 5, 1940.

Monday Afternoon, June 3: 3:00 to 5:00 P.M.

Registration.

Tuesday Morning, June 4: 9:30 A.M.

WILLIAM P. YANT, *President, American Industrial Hygiene Association, Chairman of Session:*

Address of Welcome: HONORABLE FIORELLO LAGUARDIA, Mayor, City of New York.

Response: McIVER WOODY, M.D., President, American Association of Industrial Physicians and Surgeons.

"Industrial Hygiene in Steel Plant Practice." DONALD H. CUMMINGS, Director, Division of Industrial Hygiene, University of Colorado Department of Medicine, Denver, Colorado.

"A Preliminary Report of the Effects of Exposure to Dust in the Chrome Brick Industry." W. B. FULTON, F. E. BUTTERS, A. E. GALLOWAY, F. P. KOPPENHAVER, K. R. DOREMUS and R. M. KIRK, Division of Industrial Hygiene, Pennsylvania Department of Health Harrisburg, Pennsylvania.

"Exposure to Mercury in the Manufacture of Felt Hats." HERVEY B. ELKINS, Chief Chemist, Division of Occupational Hygiene, Massachusetts Department of Labor and Industry, Boston, Massachusetts.

"Exposures to Fume and Noxious Gases under Varied Conditions of Arc Welding using Uncoated Washed Rods." G. C. HARROLD, S. F. MEEK and C. P. McCORD, Industrial Hygiene Laboratories, Chrysler Corporation.

Tuesday Afternoon, June 4: 1:30 P.M.

"Toxicity of Converted Films of Urea-Formaldehyde-Ethylene Glycol Resins when Taken Orally." T. S. HODGINS and A. G. HOVEY, Reichold Chemicals Inc., Detroit, Michigan.

"Field Determinations of Carbon Bisulfide in Air." F. J. VILES, Chemist Research Laboratory, Liberty Mutual Insurance Company, Boston, Massachusetts.

"Comparison of Gas Recorders vs Routine Sampling for Carbon Bisulfide and Hydrogen Sulfide in Air." G. M. REECE and P. DRINKER, Department of Industrial Hygiene, Harvard School of Public Health, Boston, Massachusetts.

"Dropping Mercury Electrodes for Lead Analysis."

"Application to Lead in Air." E. C. BARNES, Industrial Engineer Medical Department Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pennsylvania.

"Application to Lead in Urine." H. CRANSTON, M.D., Chicago, Illinois.

"Estimation of Small Amounts of Antimony Using Rhodamine B." W. G. FREDRICK, Chief Chemist, Detroit Bureau of Industrial Hygiene, Detroit, Michigan.

"A Rapid Photometric Method for Determining Micro Quantities of Solvent Vapors in Air." W. F. HANSON, R. & H. Chemicals Department, E. I. duPont de Nemours & Company, Niagara Falls, New York.

Tuesday Evening, June 4: Dinner Meeting.

"Light and Life — Some Glimpses into the Future." SAMUEL G. HIBBEN, Director of Applied Lighting, Lamp Division, Westinghouse Electric & Manufacturing Company, Bloomfield, New Jersey.

"Industrial Quieting and Its Advantages." L. S. AYRES, JR., Assistant Manager, Acoustical Department, Celotex Corporation, New York, New York.

Wednesday Morning, June 5: 9:00 A.M.

"Studies of the Lead Hazard in Printing."

"Engineering and Chemical Phases." H. W. RUF, Industrial Hygiene Unit, Wisconsin State Board of Health, Madison, Wisconsin.

"Medical Phases." E. L. BELKNAP, M.D., Medical Consultant, Milwaukee, Wisconsin.

"Lead Exposures as Estimated by Urinary Excretion and Effect of Vitamin C on Exposed Workers." S. W. MARCHMONT ROBINSON, M.D., Department of Industrial Sanitation, Ford Motor Company.

"Control of Possible Lead Hazards in the Production and Use of Leaded Steels." EDWIN D. MARTIN, Metallurgist, Inland Steel Company, Indiana Harbor, Indiana.

"Correlation Coefficient Between Basophilic Aggregation Test and Lead in Urine." G. C. HARROLD and S. F. MEEK, Industrial Hygiene Laboratories, Chrysler Corporation, Detroit, Michigan.

"The Significance of Clothing in Air Conditioning Standards." C. P. YAGLOU, Department of Industrial Hygiene, Harvard School of Public Health, Boston, Massachusetts.

"The Effects off Humid Heat on Colored and on White Workers." D. B. DILL, Professor of Industrial Physiology, Fatigue Laboratory, Harvard University, Boston, Massachusetts.

"Economy in Exhaust System Design." T. HATCH, Associate Dust Control Engineer, Division of Industrial Hygiene, New York State Department of Labor, New York, New York.

Wednesday Afternoon, June 5: 1:30 P.M.

"Animal Studies on the Toxicity of Antimony." WM. R. BRADLEY, Bureau of Industrial Hygiene, Detroit Department of Health, Detroit, Michigan.

"The Excretion of Carbon Bisulfide after Breathing Low Concentrations." P. DRINKER and G. M. REECE, Department of Industrial Hygiene, Harvard School of Public Health, Boston, Massachusetts.

"Absorption, Distribution and Elimination of Benzene from Body Tissues and Fluids of Dogs Exposed to Benzene Vapor in Air." H. H. SCHRENK, Chief Chemist, Health Section, Pittsburgh Experiment Station, U. S. Bureau of Mines, Pittsburgh, Pennsylvania.

"The Toxicity of Nitroparaffins and Their Derivatives." WILLARD MACHLE, Assistant Director, Kettering Laboratory of Applied Physiology, University of Cincinnati, College of Medicine, Cincinnati, Ohio.

"The Response of Rabbit Skin to Compounds Reported to have Caused Acne-Form Dermatitis." E. M. ADAMS, D. D. IRISH, H. C. SPENCER and V. K. ROWE, Biochemical Research Laboratory, Dow Chemical Company, Midland, Michigan.

Business Meeting: 4:30 P.M.

DR. WILLIS LASHER, Chairman of the Publicity Committee, addresses the following to all members of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS:

"Twenty-five years ago, a group of physicians directing the medical affairs of the nation's largest industrial corporations, banded themselves together for their mutual benefit. A few years ago in order to disseminate the knowledge which they had gained through years of experience, it was decided to take into the Association, various State

groups organized to advance the practice of industrial medicine and surgery.

"Within the past year a number of State organizations have become affiliated with the national body and the membership has increased 300%. If this year we are able to demonstrate the strength of the national organization, which will be judged at least in part by the interest and attendance at its Annual Convention, there is no doubt many individuals and groups might care to become a part of the national organization to the mutual benefit of both. This year, the Army and Navy have shown their interest in the Association's activities.

"CONSIDER YOURSELF NOMINATED AND ELECTED A MEMBER OF THE PUBLICITY COMMITTEE.

1. YOU will be mailed a number of programs. Is it seeking too much to ask YOU to distribute these among *your* friends? (Should you require more, please write for them.)

2. Many hospitals have been requested to post a notice of the Convention on their Bulletin Boards. Would YOU see if this has been done in YOUR hospitals?

3. Various County Medical Societies have been contacted for the same purpose. Would YOU see that a notice of the Convention is posted on the Bulletin Board of YOUR County Medical Society?

4. The State and National Medical Journals have been requested to publicize the Convention. Would YOU see that this has been done by YOUR State Journal?"

American Association of Industrial Physicians and Surgeons

TWENTY-FIFTH ANNUAL MEETING
Hotel Pennsylvania, New York City
June 6-7, 1940.

Thursday, June 6

9:00—Business, Committee Reports, etc.
9:30—President's Address—McIVER WOODY, M.D., President, American Association of Industrial Physicians and Surgeons.
9:50—"Pre-Employment Physical Examination"—HARRY A. NELSON, M.D. Discussion, J. J. WITTMER, M.D.
10:30—"Care and Handling of Traumatic Injuries"—JOHN J. MOORHEAD, M.D. Discussion, H. V. SPAULDING, M.D.
11:15—"Back Injuries"—J. HUBER WAGNER, M.D. Discussion.
12:15—Round Table Luncheons, separately held, on the following subjects:
"New Drug Therapy"—J. M. CARLISLE, M.D., Medical Director, Merck & Co.
"Toxicology in Industrial Medicine"—J. H. FOULGER, M.D., Director, Haskell Laboratory of Industrial Hygiene.
"Who Can Work: Evaluation of Physical Fitness for the Job"—MICHAEL LAKE, M.D., Medical Director, R. H. Macy & Co.
2:00—"Problems in Diagnosis and Management of the Nucleus Pulposis"—BYRON STOOKEY, M.D. Discussion, JEFFERSON BROWDER, M.D.
2:40—"Injuries Involving the Elbow Joint"—PHILIP D. WILSON, M.D. Discussion, JOSEPH L'EPISCOPO, M.D.
3:20—(Subject to be announced)—WM. DARRACH, M.D. Discussion, CLAY RAY MURRAY, M.D.
8:00—Twenty-Fifth Annual Dinner.

Friday, June 7

9:30—"Diagnostic Criteria in Lead Poisoning"—ELSTON L. BELKNAP, M.D. Discussion, IRVING GRAY, M.D.
10:15—"Hygiene Aspects of Welding in the U. S. Navy"—Discussion, EMERICH VON HOAM, M.D., Ohio State University.
10:45—"Occupational Dermatitis"—MARION SULZBERGER, M.D. Discussion, H. J. SCHWARTZ, M.D.
11:30—"Silicosis"—L. E. HAMLIN, M.D. Discussion, LEROY U. GARDNER, M.D.
12:15—(Subject to be announced.)
2:00—Call to Order; Reports of Committees, etc.
—"Effort and Trauma in Coronary Occlusion and Insufficiency"—ARTHUR M. MASTERS, M.D. Discussion.
2:50—"Trauma and the Peripheral Vascular System"—IRVING WRIGHT, M.D. Discussion, GILBERT MARQUARDT, M.D., Chief, Vascular Clinic, Northwestern University Medical School.
3:30—"Shock"—JOHN SCUDDER, M.D. Discussion.
—Summation—CASSIUS H. WATSON, M.D.

Shock

Book Review by

A. C. IVY, M.D.,
Department of Physiology and Pharmacology, Northwestern University Medical School

SHOCK: BLOOD STUDIES AS A GUIDE TO THERAPY. By JOHN SCUDDER, M.D., Med. Sc.D., F.A.C.S. Fifty-five illustrations, five plates, 315 pages not including eight pages of laboratory manual. Philadelphia: Lippincott Company, 1940, Price $5.50.

IN THIS monograph the author provides an outline of the historical development of the present-day theories of the etiology and the treatment of shock. The changes that occur in the blood with special emphasis upon the increase in potassium and specific gravity are indicated. A rather complete synopsis of the literature pertaining to the physiologic and toxicologic effects of potassium, including the relation of the adrenals to potassium metabolism is given. Thus, the physician and student can in a short period of time obtain much significant information pertaining to the problem of shock. The author points out that the rapid administration of preserved blood may be dangerous because certain changes in composition occur, which are chiefly due to changes in the red cells and platelets. The author describes in detail rather simple physiological tests which he employs to detect impending collapse so that early and more effective treatment may be applied. For example, he determines the specific gravity of the peripheral blood, which can be performed with ease, accuracy and speed, and which detects hemoconcentration and capillary stagnation before much change has occurred in the arterial pressure. The specific gravity is determined by the falling-drop method and can be performed with more ease and accuracy than an erythrocyte and hemoglobin determination. A concentration of the blood precedes a rise in potassium, which indicates cell injury. No patient survived when the plasma potassium was increased 100%, the prognosis being grave when the plasma potassium was increased 70% above normal. The author uses adrenal cortical extract in conjunction with sodium chloride and discusses the rationale of their use. A decrease in plasma potassium, observed in certain conditions, is also serious, no patient surviving when the decrease was greater than 25%. The author points out, however, that it is erroneous to believe that shock is due to potassium poisoning.

To some the most valuable portion of the monograph is that part which deals with case histories. This is because the case histories present the complexity of the problem of shock as it is observed in actual practice, and because it demonstrates the value of studying at frequent intervals the individual patient. These case histories

also show how the author attempted to direct his therapy toward correcting the physiological disturbances found in the individual patients.

In places the student and the physician, who is not as familiar with physiological processes as an expert in the field of shock, will wish that the author had provided more explanation of a synthetic and correlative nature. Nevertheless the author is to be heartily commended for his monograph; and it is highly recommended for study to the physician and the student. If this monograph is read in conjunction with a textbook of physiology which treats the subject of shock and with Yandell Henderson's "Adventures in Respiration," and with Moon's "Shock," the reader should gain a complete picture of the problem of shock as it is now understood.

Silicosis and Asbestosis

Book Review by

C. O. SAPPINGTON, M.D., Dr.P.H.

SILICOSIS AND ASBESTOSIS. Edited by A. J. LANZA, M.D. and with various contributors. Cloth. Pages 439, with 59 illustrations. Price $4.25. New York, London and Toronto: Oxford University Press, 1938.

THIS volume represents the first concerted effort to bring together the knowledge of the above subject in an organized fashion for those who need authoritative material. In other words, this can be considered the first American textbook on the subject.

In addition to American authors, there are also British representatives. The contributors are DRS. SAYERS, PENDERGRASS, GLOYNE, GARDNER and MIDDLETON.

DRS. SAYERS and LANZA contributed the chapters on the history, etiology, symptoms and diagnosis; DR. PENDERGRASS has 132 pages on roentgen-ray diagnosis which contains 34 very fine illustrations, together with a bibliography, which is of great value; DR. GLOYNE has written on pathology, and DR. GARDNER on experimental silicosis, and DR. MIDDLETON on occupational, preventive and legislative aspects in Great Britain. DR. LANZA concludes the book with a short chapter on the public health and economic aspects of these diseases in the United States.

Some criticism has been made of the index, of the spacing of the table of contents, and of the lack of an authors' index. In spite of these mechanical defects, which are after all a minor consideration, the material of the book stands as the best that has even been gathered.

The volume should be of very definite assistance for many years to come, to those who must know and appreciate the difficulties which have heretofore been experienced with these diseases in their many complicated inter-relationships.

Current Literature Abstracts

C. O. SAPPINGTON, M.D., DR.P.H.

COMPENSATION for Industrial Injuries and Occupational Diseases: Some Medical and Medicolegal Aspects. E. RANSOM KOONTZ. *J.A.M.A.* vol. 114, pp. 563-569 (February 17, 1940).

This paper includes material on the compensability of industrial injuries, the compensability of occupational diseases, medical and hospital benefits, free choice of physician, role of physicians in administration of compensation laws, reporting of industrial injuries and occupational diseases, and medical testimony in compensation cases. As the author states, the discussion has included only a few of the legal and medicolegal phases of the subject which are of real importance to physicians interested in the field of industrial medicine.

Tabular material is given on the compensability of occupational diseases, the regulations with respect to medical and hospital costs in injury cases and occupational diseases, and state provisions with reference to the use of medical boards or referees.

The history of the development of compensation schemes is outlined, as well as the types of laws and the administration of them. All the 48 States except Mississippi and Arkansas have compensation laws with respect to industrial injuries and twenty-four states provide in some fashion for compensation for disability arising out of occupational diseases.

The definition of the term "occupational disease" as taken from the Illinois statutes has been quoted verbatim with the conclusion that there is today in many of the states "no clear cut legal distinction between 'occupational diseases' and 'industrial injuries.'"

Considerable space is devoted to the discussion of the principle of free choice of physicians; it is concluded that although many employers have discovered that good medical service is the cheapest in the long run, the laws apply to all types of employers and also involve insurance companies — hence no injured workman should be denied the right to be treated by a physician of his own choice if he desires such choice.

Figures quoted from the Bureau of Labor Statistics of the U. S. Department of Labor as of January 1, 1938, show that 21 states have medical staffs in conjunction with compensation boards, but only eight instances have occurred where full time officers are retained. Furthermore, it is apparent that lack of funds has prevented the proper use of independent or unprejudiced examiners.

The prompt reporting of industrial injuries and occupational diseases, by law, is urged for adequate prevention and control, as well as the basis for valuable statistical and scientific data.

The concluding section on medical testimony in compensation cases contains some statements which are interesting enough to quote: "The medical profession, by medical opinions that are false or biased or founded on inadequate medical information and on possibilities rather than probabilities, has extended more or less innocently, the scope of compensation." . . . "Over reliance on medical and medicolegal textbooks is also responsible for some of the mistaken or unreliable medical testimony, because the authors too frequently round out their discussions of the etiology of pathologic conditions by adding, without scientific justification, the words 'and injuries,' or 'also due to injuries,' statements which have been copied and recopied from predecessors of even decades before." . . . "Lawyers and judges use the professional expert witness only when they have to, but they do not respect him. His position, while perhaps lucrative, is certainly an unsavory one. His conduct has brought discredit to the medical profession and has done much to make honest physicians shun the courts." . . . "High standards of qualifications for medical witnesses should be set and compliance with these standards should be required."

A final plea is made for due consideration of the possible advantages of laws specifically authorizing courts to appoint nonbiased medical boards to pass on difficult medical questions such as the relation of disability to trauma and the evaluation of disability.

INDUSTRIAL Health. *J.A.M.A.*, vol. 114, pp. 573-586 (February 17, 1940).

This article is a general statement of medical relationships in industry presented by the Council on Industrial Health of the American Medical Association, which was created in 1937. The paper includes a discussion of the scope of industrial health, population groups involved, the uneven distribution of industrial health services, effects of occupation on health, industrial accidents, occupational diseases, ordinary illness in industry, the physcian in industry, industrial hygiene, physical supervision, therapy, functions of medical service in industry, industrial health activities in organized medicine, industrial health in the government, and industrial medical education.

Tabulations supply information relative to occupations and sex according to the census of 1930, classification of industrial establishments according to number of wage earners, standardized death rates from occupational causes, disabling injuries during 1938 by industrial groups,

comparison of absenteeism from illness and injuries, increase in industrial practitioners, type of medical services supplied in industrial establishments according to size and industry, industrial health committees in state medical associations, industrial hygiene bureaus in the State governments, required instruction in industrial hygiene in medical schools including elective courses and advanced instruction, and replies of recent graduates concerning adequacy of training.

A very broad definition of industrial health is given, which includes knowledge drawn from medicine, surgery, nursing, sanitation and health education. This conception is a different one from the ordinary construction which differentiates between health and disease and upon which most medical teaching has been based for many years. Ordinarily the relationship of the general medical profession to industry has been largely curative rather than preventive.

A distinction is made between full-time industrial physicians and private practitioners, the latter really handling the bulk of industrial injuries and diseases, because of the minority of the former. Hence the statement "The ability to evaluate properly the etiologic relationships of occupation to unhealthy states and to record them promptly and in sufficient detail will constitute one of the major contributions of the medical profession to the industrial health movement," really puts a great responsibility upon the general practitioner.

It is stated in one place that the principal causes of lost time to industry for both men and women are diseases and complaints which make up the bulk of general practice everywhere, whereas it is conceded in another section that the worker commonly receives attention to minor injuries or ailments, from the plant physician largely because he is accessible and no lost time is involved.

The attitude toward industrial hygiene is one of interest both to physicians and hygienists — industrial hygiene practices are in the "best tradition of preventive medicine and do not involve competitive relationships with private practice. Nevertheless, the medical profession has certain very definite opportunities and responsibilities toward furthering and upholding standards of industrial hygiene."

The importance of cooperative relationships between the full-time industrial physician and the private practitioner is especially emphasized. In this respect the correction of physical defects is characterized as a function of private practice rather than of industry. Departures from this principle are looked upon as one of the major reasons why industrial medicine has weakened its position in the estimation of the general medical profession.

"The training which physicians receive in industrial health could be greatly improved," seems to be what has been called at times the acme of understatement, because in another place in the article this statement is found: "nevertheless it is safe to say that on the whole there has been little organized effort to acquaint the practicing profession with the best methods to improve the physical and environmental status of workers." Both of these ideas take on added significance when it is learned that the average amount of time devoted to industrial hygiene in the medical schools listed is scarcely five hours.

The majority of recent graduates of approved medical schools have reported that while surgical and first aid subjects are fairly well taught, the industrial hygiene, compensation, and insurance relationships have not been adequately presented. It is further held that there is a greater lack of graduate opportunities in the field of industrial health than deficiencies in the undergraduate curriculum. This seems especially apparent when advantage has not been taken for the development of advanced training centers in predominantly industrialized communities.

Private practitioners probably derive little assistance from special professional societies and organizations except as they gain access to publications and proceedings. It seems obvious that traumatic surgery is likely the only subject which has been actively followed.

As to residencies, fellowships and internships, these seem to be far behind other educational opportunities.

This is a very important article because it represents the attitude of organized medicine, and it should be read by engineers and other non-medical persons, as well as by

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Loss of Motion

—Discussion at the Nineteenth Annual Meeting of the New York State Society of Industrial Medicine—

AT THE Nineteenth Annual Meeting of the NEW YORK STATE SOCIETY OF INDUSTRIAL MEDICINE, at Binghamton, New York, October 10, 1939, the sessions took the form of "question-and-answer" discussions on four subjects:

1. "Abdominal Injuries;"
2. "Some Toxic Gases and Vapors of Industrial Origin;"
3. "The Relation of Loss of Motion as Interpreted by Percentage of Schedule Loss;" and
4. "Fractures of the Femur."

The questions on each subject were proposed by the members in attendance, and the discussions were given by the members of the INFORMATION BOARD named in advance.

The Discussion on "Abdominal Injuries" was published in INDUSTRIAL MEDICINE for February, 1940 (pp. 97-100).

The INFORMATION BOARD for the third subject, "The Relation of Loss of Motion as Interpreted by Percentage of Schedule Loss" included DR. WILLIAM HUGHES, of Albany (chairman), DR. FERDINAND SCHMITTER, of New York, and DR. FRANCIS J. HALEY, of Buffalo. The discussion of the third subject follows:

DR. JENKINS: We will now proceed with the next section on the program in which we will consider the loss of motion as interpreted in percentage of schedule loss.

DR. HUGHES: There are certain schedules which have not varied very much in over 10 years. These are the schedules most frequently made; that is, schedule awards for loss of hand and arm, foot and leg, finger and toe. Ankylosis of a distal joint of a finger constitutes 50% loss of use of the finger; you may also use the term "immobility" or "flail joint," but they mean the same thing. Ankylosis of a proximal joint constitutes 100% loss of use of the finger. By ankylosis is meant complete loss of motion in a joint. The loss of voluntary motion, due to tendon injury, is its equivalent. Bone loss of ½ or more of a distal phalanx constitutes 50% loss and loss of use of the finger (the latter terminology being legal and not medical). Bone loss of ½ or more of a middle phalanx constitutes 100% loss and loss of use of the finger. Percentages in between 50 and 100%, and lower than 50%, are made at the discretion of the individual examiner. Disabilities due to pain and loss of sensation are carried as disabilities and not as schedules. They may in some cases be disposed of by lump sum adjustment on a disability basis.

The same ideas on schedules apply to the toes of the foot except the great toe. The great toe and the thumb are in the same class in that they have only one interphalangeal joint and immobility of that joint, which is a better term than ankylosis, entitles the claimant to a 50% loss of use of the great toe or thumb. Involvment of the metatarsophalangeal joints, or the metacarpo-

phalangeal joints enters into a schedule of hand or foot, and are so rated, because these joints enter into the complex functioning of the foot or hand itself. Loss of one or more phalanges of two or more digits entitles the claimant to a schedule loss of use of hand. Now, that proviso has just been altered by the Appellate Division to read that, loss of one phalange and any part of another may be made a proportionate loss of use of the hand. That's a new interpretation of the law, occurring within the last six weeks. In computing these schedule losses of hand or foot an additional number of weeks is added to compensate the claimant for a loss of part of the function of the entire hand due to the loss of the fingers or thumb. This load is usually ½ again the amount given for the fingers. The two are added together and divided by 244, the number of weeks allowed for total hand, in order to obtain the percentage loss due to any particular injury. This also may be varied at the discretion of the individual examiner but should not vary, as it does now, more than 5 or 10%. The 50% load method follows very closely a graph which was computed sometime ago for hand injuries from zero to 100% loss of use of the hand. The ordinary engineering graph is used. This same principle applies to the foot as far as schedules go except that the dividing figure would be 205, the total number of weeks for loss of use of foot. Proceeding now to the wrist and ankle, the award for immobility of these joints would be ⅔ of the foot or hand. Allowing 20% each for flexion and extension of these joints and 10% each for pronation and supination or inversion and eversion, these schedules can be figured quite accurately. Flexion and extension are given more, because they seem to be more important, functionally. So far as the knee and elbow are concerned, complete immobility of the knee would rate ⅔ of the leg schedule, whereas the elbow, being a more movable joint, should receive a higher schedule. Pronation and supination are a part of this joint as well as flexion and extension, and, therefore, complete immobility would rate a higher schedule than that of the knee, probably sometimes as high as 70% of arm, in the discretion of the examiner.

So far as the shoulder and knee are concerned, these are the most difficult joints and there is a great range of opinion on schedule loss. The two fixed points that we have are elevation of the arm at the shoulder in direct abduction (the most difficult motion at the shoulder), and abduction of the leg at the hip. This latter movement of the hip is one which tilts the whole pelvis and may bring the case from a schedule into a non-schedule classification because of pelvic and back involvement. Limitation of motion at the level of the clavicle in direct abduction of the arm has been rated at 40% and the other motions accordingly.

In regard to certain injuries in which claimants refuse operation, should they be handled as continuing disabilities or settled as schedules? I refer particularly to the fractured scaphoid, ununited and unoperated, and the loose internal cartilage of the knee, unoperated. Both of these conditions have been settled, either wisely or unwisely, at 20% of the hand and 20% of the leg. The claimants, apparently, would rather have their cases adjusted on this basis than continue on reduced earnings. There are other types of these injuries also. One is that of rupture of the biceps which has not been repaired by surgery. The usual award for this has been from 20 to 25% of the arm. Another condition in this group is that of peroneal palsy or foot drop, which has been rated at 20 to 30% of the foot. The question is sometimes asked whether the application of braces should enter into the calculation of schedule awards? If the braces are temporary, as arch supports often are, their presence at the time of final hearing should not enter into the estimation of permanency. However, if the braces are permanent and must be worn for life this should be considered in the estimation of permanency.

Now, we might as well take up amputation also as long as we are on the same subject. Amputation above the ankle and above the wrist must be made a percentage of arm or leg rather than hand or foot. I believe these estimates are best made by using comparative x-rays of both extremities and calculating the percentage loss from the actual bone loss. Let us suppose that a claimant loses an entire foot and ⅓ tibia and fibula as shown by comparative x-ray measurement. The award should be for a percentage loss of leg equal to the weeks allowed for a total foot—205 plus ⅓ the difference between total foot and total leg, approximately 80% of the leg. The same type of calculation would apply to the hand and arm where there has been an amputation at or above the wrist. Schedules resulting from contractures due to burns or paralysis of peripheral origin should also be based on the amount of permanent atrophy and permanent restriction of joint motion. Atrophy of disuse is different and should not be included in a permanent schedule.

We have here a list of plain and simple rules applying to all schedules. You would be surprised how often they are not followed, and if the case comes up for final judgment without this comparatively easy data the x-ray man loses a lot of money. The case has to be adjourned again for final hearing. In regard to comparing both extremities, I had one fellow who took off the shoe from the injured foot and when I asked him to take the shoe off the uninjured foot so that they could be compared he said he only washed one foot because he only expected one foot to be examined.

1. Compare both extremities for restriction of motion before making any schedule.

2. Have comparative x-rays of both extremities for bone loss in amputations and for arthritis before making any schedule, that applies particularly to arthritis around the shoulder joint.

3. Don't make any schedules on the arms without comparative x-rays of both shoulders.

4. Do not pass on schedules in less than six months for fingers, toes, and hand and foot; nine months for arm and leg.

5. In schedules due to nerve involvement do not pass on aids such as protractors, or of the 30-60-90° triangle in motion or grip.

6. A flail joint due to tendon injury is the same in a schedule as a joint injured by ankylosis or amputation so far as a schedule goes.

7. Facial disfigurements are not passed upon until six months and they are solely up to the referee.

Q. To bring up the question of foot drop and other deformities where permanent braces are needed, as I gathered from what has been said, the schedule is not changed by using braces furnished by the insurance carrier. In other words, that does not detract from the schedule loss?

DR. HUGHES: If the brace is permanent it enters into the loss. I can make it a little easier with the knee. Suppose a man has a relaxed joint and in order to immobilize that knee he has to wear a brace with a cuff on the thigh and a cuff on the lower leg, and he has to wear that for the rest of his life. That gives him what amounts to ankylosis of the knee and he should receive the same award for that as if he had a bony ankylosis of the knee.

Q. And the insurance company is responsible for furnishing that particular device?

A. Yes.

Q. If the medical care goes on forever that does not detract from schedule loss?

A. Not a bit.

Q. And the same thing holds for drop foot where he has to have a permanent drop foot device?

A. That's right.

DR. SCHMITTER: I would like to emphasize what Dr. Hughes said about the difference between these legal things and medical things. You all know certain things as medical doctors but, while we go by our medical knowledge in general, we have to go by the interpretations of our higher courts, the Industrial Board, the Appellate Division, and the Court of Appeals. What they say goes with us whether it is right or not. We try to do justice to our cases but in all cases we go according to

the law whether the law is just or not and, as you know, the law has been changed at times and the decisions of these courts have been changed at times. All we have to do is to follow those decisions.

It used to be amputation up high on the arm, any amputation, was hand if it was below the elbow. According to these interpretations now, anything above the wrist is arm and above the ankle the leg. Doctors are often irked by this. I was myself, until I learned to accept things as they were. Many of you have had Army experience; we used to get together on a Board and pass on a case. The regulations said, in view of his occupancy, to what extent is he disabled. Most doctors looking over the case could come pretty close to saying what this was, and that Board or group of doctors did pretty much justice. Now and again we have had doctors and lawyers arguing—this man's occupation is so and so and he should get more. But, according to the Labor law, a man is a pick and shovel artist and on that basis we make an estimate of his disability. So, again to illustrate this distinction between medical and legal things, every one of you when you were a medical student and learned embryology knew there was no such thing as traumatic hernia. In fact, away back in the nineties an Army Board assembled and studied the whole subject of hernia and reached the conclusions that nobody in the hernia class got it from causes due to duty, and that the conditions were caused before enlistment. But the Army said that every man should be improved as much as he could for the service, the operation being in the line of duty, and any complications also being in the line of duty. It put the thing in a logical form for medical men. Now our courts in New York State, through a number of years, on the testimony of some doctors have developed this traumatic hernia and indirectly reach the same result. Therefore I would like you to bear with us on some of these things that may sound unreasonable, because we are not making our own interpretations—we are simply accepting the interpretations of lawyers on these schedules.

Q. I know that the law covers two phalanges or their equivalent, I can't express it exactly, but Dr. Hughes brought up something that was a little new to me. It is that one phalanx or part of another phalanx can be expressed in the terms of a hand?

Dr. Hughes: That's right.

Q. May I ask if the loss is the same, approximately 50%?

A. Yes.

Q. If we lose one it is 50%. If we lose *part* of another it is what?

A. Less than 50%, at the discretion of the examiner.

Q. In what general way are disabilities of the back figured as schedule loss?

A. They are not figured as schedule losses, those are disabilities.

Dr. Schmitter made a remark which it seems proper to take up here. He said, we are accepting not what the medical knowledge dictates but what the lawyers say. Now it seems to me that it is our job as doctors to interpret according to medical facts and not according to what some lawyer decides about it. And it should be done through some such group as this. These things should be corrected to fit the medical facts.

A. I didn't read this concluding paragraph in my outline here because I didn't think it was necessary, but I said at the end here: Could all these various schedule cases be codified? Only by a table in which the minimum schedule loss for each type of injury would be given. Certain minimums I think can be easily established—not only for hand and foot, arm and leg, but also for individual members of hand and foot. These standards need not be rigid or fixed but merely indicate approximately what the award should be for an easily recognized condition. The award may be for more than the average case calls for, but there can be reasons for raising the estimate, such as permanent edema, deformity, or malposition of fragments at the site of fracture. It would take some sort of committee, as of this Society, to work out such a schedule with the cooperation of insurance experts, State examiners, employers and employees. But I believe it could be done, although it would take considerable time and thought on the part of all parties.

Dr. Schmitter: I have heard doctors say a man has a finger amputated, that is half the finger, and we will give him half. But legally that's a whole finger. You see it is by the courts and the loss of the use of a whole finger. An amputation right in the middle of the middle phalanx is a half-finger to you and me but it is a whole finger to the courts. These are interpretations. Right here (indicating on drawing) we have the bone in this initial phalanx. If half of that is amputated, half of the distal phalanx makes half a finger. Now then, there is another question. Suppose you get amputation down there, (indicating) what they call a substantial loss, it is a technical word. Substantial loss has been interpreted by the courts as meaning half or more than half of that particular phalanx. So, a substantial loss of a phalanx, as shown by the x-ray, is the whole phalanx.

And here is another point that we even have dispute among the examiners, men of 20 years' experience refuse to agree on a little point like this: If a man gets the tip of his finger clipped off has he any schedule loss, no defect in the joint, and without bone loss?

Dr. Hughes: There is no schedule if there is no bone loss.

Dr. Schmitter: I always give those fellows a little schedule.

Dr. Hughes: That would be disability for loss of sensation.

Dr. Schmitter: Well I think the use of the finger too. The way I settle this is as follows: We have an insurance carrier representing the company and the claimant there he has this tip of his finger clipped off and he knows he has a disability and you can't talk him out of it, so I say to the carrier, this man has no schedule loss in the technical sense of the word but give him a little schedule loss to settle it because it really constitutes a partial disability and those are tough to deal with. I never fail to find the carrier is glad to give the man 5 or 10% of the finger and call it off. That is one more of those points, not "no award" but settled personally at the discretion of the individual.

Q. I am still hazy on the question of the attitude of the Commissioner's examiner on, not a fancied loss of sensation, but actual loss without motor involvement?

Dr. Hughes: If the examining physician feels that a man has an actual loss of sensation he is entitled to loss for disability. If he makes less money due to reduced earnings he is entitled to it.

Q. I am interested in paralysis of nerves. We have a nerve gone permanently. How do you schedule that?

Dr. Hughes: It depends on how much permanent atrophy, how much restriction of joint motion is a result of that. He may have to wear a brace permanently and I should think he would be entitled to at least 33⅓% loss of use of his foot, if it is a foot.

Q. And permanent bracing on it?

A. Yes.

Dr. Schmitter: There is another word I would like to add on this point, the question of scheduling other things than amputation and elimination of motion in joints. Some liberal minded people interpret the word "defection" and it should be defined by our courts but it is not. Some interpret it as "elimination of motion in the joint." Sometimes you may have a flailed knee and the Referee decides if a man has a flailed knee you may schedule that or may not and the Referee will either take your schedule or not, depending upon which is going to be to the advantage of the man. If the man can't get any work on account of a flailed knee he is going to have that partial disability for the rest of his life and he will be paid that for the rest of his schedule.

Dr. Hughes: The doctor describes the conditions and the Referee makes the award or not as he sees fit.

Mr. E. J. Deering, Referee, N. Y. State Department of Labor, N. Y. City: I might say that the Referees are generally guided by the report made by the doctors of the State Department of Labor. Now you remarked just now

relative to that man's knee. It may not be of any permanency yet the man is complaining of certain conditions. Well you say it could be put on schedule. It is true if there is any condition that may warrant it, but if there is a condition that warrants it we will place him on partial disability provided the doctors say so.

DR. SCHMITTER: I had reference to the actual partial disability such as a flailed knee, a loose knee we may offer a schedule or not. Now a stiff knee we will schedule. We are not bound to schedule a loose knee.

Q. May I assume then, DR. HUGHES, that the anesthesia without loss of motion is a thing at the discretion of the Referee?

DR. HUGHES: Yes after the doctor describes the conditions.

Q. And that an ankylosed knee in the opinion of the Commissioner's examiner as ⅔ loss of use of leg?

A. Yes.

Q. And that a flailed knee may or may not be, at the discretion of the Referee, equivalent to an ankylosed knee?

A. Yes.

DR. SCHMITTER: At the discretion of the Referee on advice of medical examiner.

Q. But it is, after all, not as set a thing as an ankylosed knee?

DR. HUGHES: That's right.

Q. An ankylosed knee is two-thirds loss of the leg but a flailed knee may be modified by the opinion of the Referee?

A. Yes.

DR. SCHMITTER: And what you say about the knee applies to all other members of the body. By members I mean arms, legs, hands, fingers and toes.

Q. One of the easiest nerves in the body to repair is the peroneal, the ulnar also is a very easy nerve to repair. Can a man be required to have an effort made to make the repair of his nerves which will restore function in quite a large percentage of cases?

DR. HUGHES: A man can't be forced to have that operation. He can be advised to take this operation as being in his best interest but he is the sole judge as to whether or not he will have that operation.

Q. How would you schedule an ulnar nerve paralysis without the function of it?

A. I don't think such a thing exists.

Q. A man has a hernia and refuses surgery. How do you test that?

DR. HUGHES: A permanent disability if the man has to wear a truss.

Q. I have these following things which I think are in line with the previous questions. A man refuses operation, am I correct in that if he refuses operation for say any internal cartilage he will automatically get 20% loss of leg?

DR. HUGHES: No. Some examiners will treat it as partial permanent disability and other examiners will treat it as 20% loss of leg.

Q. But I mean, some one has a definite dislocation of semi-lunar cartilage, it can't be scheduled at the demand of the carrier, am I correct on that?

A. It is either settled or operated. He has no right to demand either.

Q. If he has a rupture of his biceps, your best estimate if he refuses operation is 20 to 25% of an arm?

A. Right.

Q. He cannot be forced to take that schedule or operation?

A. He cannot be forced to take that schedule or operation.

Q. Immobilization or ankylosis of the metacarpal joint of the thumb which inflames the joint?

A. I would say percentage loss of hand because all the metacarpal joints are part of the hand.

Q. If a man has complete motion you couldn't consider it at all?

A. No. He must have abnormal motion, or loss of motion.

Q. Suppose this man that has the hernia that refused surgery has a laboring type of job that he can't do with the hernia, what happens then?

A. Go back to light work.

Q. Maybe he has none?

A. If he testifies he is unable to do it he is entitled to partial permanent disability. The case on which the justifiability of refusal of operation is a very interesting one. A man had an injury to his eye. It developed infection of one eye and the doctor advised him that if he didn't have the eye removed he would develop a sympathetic ophthalmia of the other eye and would become totally blind. This is a clear cut case. The man was going to become totally permanently disabled if he didn't submit to the operation for the removal of one eye and the man refused and he lost the sight of both eyes and became a total permanent disability and his decision not to have that operation was deemed reasonable by the Court of Appeals. That is a test case on the question of operations.

Q. I thought the court made the usual allowance of disability following an operation and paid six to eight weeks without operation?

DR. SCHMITTER: You are mistaken.

Q. Assuming that the chances are excellent from a medical standpoint for taking a man from total disability to probable return to his normal ability to work, say when from the standpoint of the medical man and from the standpoint of the ordinary layman, say he is taking an unreasonable attitude in refusing operation, can a Referee take that into consideration in making a lump sum settlement or in refusing the man further disability payments? Assuming that this man has a thing that is comparatively easily correctable and many doctors agree that without much danger to him he may be brought from a status of complete disability to the point where he can do his usual work, I mean an operation that is generally accepted by the medical profession as being the proper operation and carries no more danger than ordinary simple operations and he refuses and it is expected that that operation may make him able to go back to work if he had the operation. The doctor testifies that he probably could go back to work if he had the operation. Could the Referee or would the Referee be in a position to either make a lump sum settlement, taking into consideration his position, which is not tenable to making a lump sum settlement, or reduce his disability because he has been so unreasonable?

MR. DEERING: The Referee could possibly make a lump sum settlement if the man is totally disabled and he refuses an operation. He would be perfectly at right to do that under those circumstances. I don't think any Referee would make a lump sum settlement. He would continue the case on total disability.

Q. He can refuse any operation?

DR. HUGHES: Yes.

Q. But would his refusal to accept an operation that carries a small risk influence his compensation?

MR. DEERING: How could it be a small risk? Even at that the claimant is the one to judge.

DR. HUGHES: The claimant is the sole judge as to whether or not he submits to an operation.

Conservatism

—In Traumatic Surgery—

JAMES F. MITCHELL, M.D.,
Washington, D. C.

IN THESE days of rapid transportation traumatic surgery has attained a high place in the work of any general hospital. One of the important duties of every hospital is the training of interns. This applies not only to the technical treatment of disease and injury, but especially to the cultivation of judgment as to what to do and when to do it.

I recall vividly two major catastrophies here in Washington, the fearful Terra Cotta wreck on the B. & O., and the collapse of the Knickerbocker Theater roof. In both of these a sort of hysteria prevailed and doctors unskilled in traumatic surgery undertook to operate. The prevailing idea seemed to be that immediate operation was necessary in every instance. Therefore, many ill-timed and some unnecessary operations were done before sounder judgment intervened and a clearer view of the situation prevailed. In the Knickerbocker accident over 100 injured were brought to Emergency hospital between 9:00 at night and 6:00 the next morning. We at once separated them into three classes, the hopeless ones for whom nothing could be done; the slightly injured who needed only dressings; and those on whom operative procedures were indicated. These last were carefully prepared and placed in the hands of competent surgeons. As a result we had no deaths in the operated cases and no serious infections.

It is well understood that certain conditions do demand immediate attention, as where there is extensive internal hemorrhage; but even here measures should be instituted to overcome shock, and the vast majority of injuries can be more safely and thoroughly treated after careful preparation. The most important measure at our disposal is blood transfusion and every hospital caring for traumatic cases should develop some scheme for this procedure to avoid delay. The recently devised plan of blood banks is ideal, but in small institutions it is almost impossible. We have found the establishment of a transfusion fund an excellent substitute. Tested and typed paid donors are kept available and when a transfusion is urgent the donor is at once paid from the fund. Later, if the patient is able, the fund is reimbursed. The drain on the fund is thus found to be very slight. It should be emphasized that transfusion should be considered as a prevention rather than a cure and by its aid the patient may be tided over the dangerous period of shock and the operation safely performed.

Thorough training of the emergency room team in these principles will go a long way toward success. As an example a man was brought in at five in the morning having had a street car crush off his right hand with dirt and grease ground into the tissues. He was in shock. By the time I saw him half an hour later he had been given tetanus and gas bacillus antitoxin and an intravenous infusion of glucose solution and was in good condition for the necessary amputation.

CASE I: At the time of the Knickerbocker disaster a great friend of mine, a dentist, was brought to the hospital at 6:00 in the morning having been buried under tons of snow and concrete since 9:00 the previous evening. A steel beam had crushed both his legs and had to be burned away with an acetylene torch before he could be moved. He was in shock, cold and almost pulseless, blood pressure 95. After getting him warmed up and stimulated he was given a large blood transfusion, 800 cc., and he was taken to the operating room. Only local anesthesia was used. At first sight it looked as though a double amputation would be necessary. The left tibia and fibula were sticking out half way between the ankle and the knee with a large piece of concrete wedged between them. The foot was lying up against the thigh. Circulation of the foot, however, seemed good. The wound was cleansed by thorough irrigation and the bones brought into apposition. After removing the devitalized tissue an opening was made in the skin posteriorly for drainage and the whole wound packed with weak bichlorid gauze. The leg was then fixed in plaster. No attempt was made at closure. The right foot was crushed off leaving the heel in place. This was treated in the same way as the left without closure. Five days later his condition had improved so much, his temperature being normal, that he was taken to the operating room again. The gauze packs in the left leg were removed, a little sloughing skin was cut away, and under a whiff of gas the wound was closed without drainage. He had no temperature following this and did well, although his hemoglobin at this time was still only 46. Four days later he was again taken to the operating room, and under gas anesthesia a Syme amputation was done on the right foot. He made steady progress and has obtained an excellent left leg and after getting an artificial boot for his right side he has been able to continuously carry on his work as a dentist.

CASE II: This patient, aged 75, was brought into the Emergency hosiptal on February 16, 1939, having been struck and knocked down by a truck. She was said to have been unconscious at the time of the injury but arrived in the hospital quite conscious and complaining bitterly of pain in the left side about her lower ribs. Abdominal examination showed acute tenderness in the left upper quadrant anteriorly and posteriorly and also tenderness throughout both sides of the chest. She had a lacerated wound of the scalp which was sutured in the emergency room and she was complaining also of intense headache. She was in some degree of shock. She was put to bed and a short time after admission passed urine which was practically pure blood. She was kept quiet in bed and although we felt sure that she had a ruptured kidney, considering her age and her other injuries it was decided to treat her conservatively. Her urine cleared up in three or four days and she had no further trouble. A thorough x-ray study was then made and she was found to have a linear fracture of her skull which started anteriorly, passing all the way through the occipital bone into the foramen magnum. She also had a fracture of eight ribs on the left side and three on the right. Under conservative treatment she improved steadily and was able to walk out of the hospital in a month apparently in perfect health—her urine clear, her dizziness gone and having no further pain from her fractured ribs.

CASE III: A boy, 13 years of age, was admitted to the hospital in November, 1938, having been run over by an automobile. He was in extreme shock, blood pressure 80, pulse 160. He had an extensive lacerated wound in his right lower abdomen which apparently did not extend into the peritoneal cavity. His breathing was shallow and labored. He was wrapped in warm blankets, hot water bottles placed about him and he was given glucose intravenously at once. X-ray examination of his chest showed a pneumothorax on the right side and no demonstrable injury to the ribs. There was a fracture of the left transverse process of the 1st, 2nd, 3rd and 4th lumbar vertebrae with no displacement. Kidneys were normal in size and position. X-ray of the pelvis showed a slight separation at the epiphyseal line of the acetabulum on either side with no displacement. Rupture of the liver was suspected because of the rigidity in the right side of his abdomen but it was deemed wise not to subject him to any abdominal exploration because of the extreme shock and his bad condition. He was put to bed, given a transfusion and was also given nasal oxygen. During the night his blood pressure under this treatment rose to 110. He vomited several times. The lacerated wound in the right side of his abdomen was cleansed and strapped together with adhesive plaster. The boy made an excellent recovery. His abdominal wound healed per primam and his pneumothorax gradually cleared up. He was able to leave the hospital in three weeks in excellent condition. I believe that any operative interference with this boy would have resulted in death.

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Industrial Hygiene Division

IN Philadelphia, not long ago, a worker in a printing establishment died of benzol poisoning.[1] This prompted the experts in the Industrial Hygiene Division, New York State Department of Labor, to investigate the subject in that State, where it was found that the same new, fast-drying ink containing benzol was in use in three large plants and that one man in one of these plants had already died of acute benzol poisoning. Physical examinations were promptly made of all of the workers in these three plants. These showed the danger of the benzol-containing inks. The Division recommended discontinuance of their use and the employers agreed. Some cases discovered were given needed medical or hospital care and soon were back on their feet. None lost his job. Many lives were saved.

Bulletin No. 31 (see citation) describes the varied activities of the New York Division which is engaged in checking up on new industrial diseases, tracing them to their sources, and developing safe production methods to protect workers. The Division assists committees of labor and industry representatives who formulate safety codes. Its laboratories test air samples, or chemical and physical substances, that workers are exposed to. It tests safety devices, both in the laboratory and under actual working conditions. It sits in on workmen's compensation cases, furnishing a medical opinion that is not only impartial but also expert in diagnosing the worker's condition and determining whether it resulted from exposure during employment. Both labor unions and employers' organizations frequently call upon its experts.

The Division is now studying health hazards in New York's fur industry, in which physical examinations of some 1500 workers is a feature. Skin diseases and asthma are common in the industry. This combination of chemists, engineers, and doctors serves a most useful purpose.

1. Bull. No. 31, Division of Labor Standards, U. S. Dept. of Labor, Washington, D. C., 1939. Available without charge.

Disabling Morbidity

DATA on the frequency of sickness and nonindustrial injuries lasting eight consecutive calendar days or longer during the third quarter and the first nine months of 1938 and 1939 are derived from analyses of reports from 26 sick benefit organizations representing 170,000 members of establishments located east of the Mississippi and north of the Ohio and Potomac.[2]

A comparison of the third quarters for 1939 and 1938 reveals only minor differences in the broad complete groups: Respiratory diseases, digestive diseases and nonrespiratory-nondigestive diseases. Of interest, however, are the 20% decreases shown for diseases of the pharynx and tonsils and diseases of the stomach, except cancer; and the increase, almost 25%, in appendicitis.

One table discloses the 10-year behavior of the frequency of diseases of the skin which is of considerable interest. For any given year the rate for the third quarter is always the highest of all quarter rates. This phenomenon is particularly striking because, first, a time curve representing total disability is generally lowest in the third quarter, and, second, a definition of "diseases of the skin" does not include sunburn, poisoning by organic substances, nor the mycoses.

An inspection of the frequencies for the first nine months of 1939 and 1938 in the light of the experience recorded for the third quarters reveals an unfavorable sickness rate for 1939 (92.2 vs. 92.5, and 89.5 for 1934-38). This has been due principally to the excessive rate for influenza and grippe in the first and second quarters of 1939.

2. From the Division of Industrial Hygiene, National Institute of Health, Bethesda, Maryland, as prepared by Dr. W. M. Gafafer.

Those Archives

THEY are interesting, those archives! Browsing among them yields many paragraphs of years ago which apply with as much force to the immediate present as to the times for which they were written. Thus, for example: "Watkins in 1920 expressed the following viewpoint: 'It took the medical profession quite a while to realize that the possession of a sound medical education did not, per se, qualify a man adequately to carry on the duties of a health officer. The profession has likewise been somewhat slow to recognize that the acquisition of sound surgical technic or skilled diagnostic ability does not qualify a man to carry on the duties of an industrial physician.' "[3]

3. C. O. Sappington, M.D., Dr. P.H., in an address before the Illinois Academy of Science, May 6, 1932.

INDUSTRIAL HEALTH AND DISEASE

Is There a Doctor in the House?

THEODORE L. STORY, M.D.,
Medical Director, American Optical Company, Southbridge, Massachusetts

THE subject, "Is There a Doctor in the House?" is an old and popular remark. To us who are interested in industrial medicine, we might appropriately say, "Have You a Doctor in Your Factory?" Many are inclined to think that industrial medicine is a new form of medical work. As a matter of fact, if we scan the literature pertaining to industrial medicine from a historical standpoint, we find that the real beginning of industrial medicine and hygiene dates at least back to the publication of the "First Systematic Treatment on Diseases of Occupation," which was published by Professor Bernardo Ramazzini, of the University of Padua, Italy, in 1700. It is interesting to note that the descriptions of industrial occupational diseases contained in these old treatises were surprisingly accurate, and one cannot read these books without being impressed that the observers knew a great deal about this special phase of medicine.

On looking over the literature relative to industrial medicine, we find that the American manufacturers entered the field somewhere between the years 1910 and 1920. This was concurrent with the enactment of laws to protect the working man. Following the original enactment of this type of legislation, it was not long before various amendments were introduced in the different State legislatures, with the result that there began the momentous growth of liability to industry side by side with the increasing number of hazards encountered in manufacturing.

The manufacturer, in attempting to attack this problem of liability, saw the proposition at first purely from an economic standpoint, and it was soon demonstrated that prevention was valuable from a social and humanitarian standpoint as well as economical. Hence, we may say that prevention was the first step taken in the program of so-called safety control.

Legislatures, quickly recognizing this effort towards accident prevention on the part of the manufacturer, consequently enacted laws placing a monetary value on specific injuries. As a result, compensation rates were based on a percentage of the workers' average yearly income. Specific losses in terms of dollars were established based on that part of the body which became totally or partially permanently disabled, as the result of an accident.

It is evident, therefore, that soon compensation laws became very drastic, and as soon as safety control methods were introduced, the results became apparent over a definite period of years, when we find accidents falling off anywhere from 75% to 85%. With safety control definitely established, it became obvious to the manufacturer that a medical program in industry should go hand in hand with the safety control program. It soon became evident that the handling of major or minor accidents by physicians inexperienced in industrial accident work, indiscriminately selected either by the employer or the employee himself, resulted in the total cost of the care of that employee becoming nearly double what it would have been under a unified medical service, that is, a medical department under the control of a responsible physician working equally for the interest of employer and employee.

THE American Optical Company, of Southbridge, Massachusetts, always alert for progressive developments in its own manufacturing field, as well as in the improvement of the social and economic status of its employees, was quick to recognize these facts, and we find that in the year 1919 they established a dispensary with a personnel of a full time physician and two graduate nurses.

Since that time development of the medical department has been rapid, so at the present writing we find the company has set aside a definite clinic manned by a personnel of a full-time physician, three graduate nurses, and a secretary.

The equipment is the most modern and consists of all diagnostic instruments necessary for the proper functioning of such a department. All clinical facilities are available that may be found in any outpatient department of a large city hospital. The development of this department has reached a point now where medical and minor surgical service is available for some 3,800 employees. No provisions are made for major surgery, inasmuch as this department feels that such cases should be referred immediately to the hospital. Fortunately, our manufacturing organization is not engaged in work which is apt to produce major accidents. A complete record of the department is maintained in charge of a secretary, so that complete history and physical records are available for each employee treated either surgically or medically at the clinic. All accidents that are potentially of a serious nature are immediately followed up by investigation reports, and as a result, no accident which in any way might lead to serious consequences is overlooked. The responsibility for the cause of the accident is definitely established at the time the accident occurs.

All appointments to see the nurse or doctor are made by telephone, and as a result, the waiting room is never filled with patients losing time. Also, only one worker is taken away from any particular room or type of work in which he or she may be engaged at any one time.

Dressings and minor ailments can be well taken care of by the attending nurse. Cases requiring further consideration are referred to the doctor.

Employees are taught to feel that when they request service at the dispensary they are being considered as patients and not as employees. This has a pronounced psychological effect. It gives the employee a feeling of personal contact with the management. As a result of this established practice, a most cordial feeling has developed between employee and employer, with the medical department acting in a capacity of a liaison office.

Consultation and advice are freely given, and cases requiring prolonged treatment and medical care are referred to the family physician. As a result of this practice in our industry, cooperation and harmony has developed between the plant physician and the outside doctors.

The question of pre-employment physical examination leaves no doubt of the desirability of such a program as seen by the medical department of the American Optical Company. The physical examination of a new employee is a valuable adjunct to the personnel department, because it means that the man selected for a particular job is given a careful physical examination, and before he begins employment the management knows whether or not he is physically fit to engage in the prospective job. Needless to say, care and discretion must ever be maintained in carrying out these examinations, and a certain latitude must be allowed, so that our rules do not become so rigid as to bar people with average physical conditions from employment. In other words, you cannot maintain the physical examination of

From *Industry*, published by the Associated Industries of Massachusetts.

a prospective employee for a manufacturing plant on the same standard that you would a West Point cadet. At the same time, you must bear in mind the danger of accepting those with disabilities which may become aggravated by the work, and which would make them liabilities under compensation law as the result of an aggravation of a pre-existing condition. In addition to the physical examination of new employees, a yearly examination is offered to all employees 45 years of age or over. This has always been optional but has become so popular with the workers that practically 100% of our employees avail themselves of this opportunity yearly. These examinations are most interesting and reward one for the painstaking effort put into the work. Many cases which were in the early stage of some physical disability have, according to our records, been benefitted by either increasing their life span or eliminating future pain and suffering. As a result, their useful years of earning have been prolonged, which not only has resulted in an economical and social value to employee and employer, but to the community as well.

WITH such a program as outlined, what has it meant to a company such as ours? Time and space prevent enumerating all the valuable returns for the investment. However, during the last year, our medical department shows a record of having given over 36,000 treatments, a daily average of more than 100, this figure including both medical and surgical attention. Our lost time accidents totaled 10 with 375 total days lost. It can readily be appreciated from these figures that the amount of compensation paid, as well as outside medical care by American Optical people has been at a minimum. The cost of maintaining a department such as ours averages about $4.56 per employee per year. If one should ask, "Is medical service a profitable investment for a large industrial plant?" the answer of the American Optical Company would be "Yes." Although no one has been able to devise a trustworthy measuring rod that would give a satisfactory answer to this question, there are, however, many sidelights and indications that favor the belief that medical service is most profitable to employer as well as to employee.

As so well stated by Dr. Victor G. Heiser, Consultant of the National Association Manufacturing Committee on Health Working Conditions, if we put aside for the moment the humanitarian considerations, we have such facts as these:

Wounds and injuries treated promptly on the average, get well much more rapidly and are much less likely to result in permanent disability.

It has been shown that the accident rate is not as high among workers having good medical attention.

To quote from our own records at the American Optical Company, since the introduction of a Medical Division, the accident rate has shown a marked decrease, with a definite reduction in compensation payments and absenteeism.

We feel here at the American Optical Company that the death rate among our industrial workers having medical care has declined more rapidly than that of the general population.

During the depression of the early 20's medical services were often eliminated, whereas in the depression of 1929 when economies were necessary, they were only proportionately reduced with other departments.

As Dr. Heiser says, it is the consensus that good medical service with a follow-up system is one of the greatest factors for producing good will and promoting amicable relations between employer and employee. The reduction of accidents is also a direct result.

The American College of Surgeons, having recognized that industrial medicine has a definite place in medicine as well as in industry, formulated minimum requirements for a well organized medical department, so that in order for an industry to have a certificate from the American College of Surgeons, it is necessary that it meets these minimum requirements thus creating a standard.

From the standpoint of the medical school, it seems to the writer that the importance of this work is definitely assured. Hence, we who may be called pioneers must look to the future doctors as our successors. It is imperative, therefore, that our places be taken by men trained for this work and a course in industrial medicine should occupy a part in the medical school curriculum. It is felt by the writer that a definite course should be embodied in the medical school, not as we see it today with a more or less sporadic program touching on various phases of industrial medicine such as occupational diseases, etc., in order that the young doctor who may desire to specialize in the field of industrial medicine may have a thorough theoretical background with as much clinical material as possible before stepping into the job as industrial physician.

It is apparent that the enormous strides which have been made in this particular field over a period of 20 years make it mandatory that the progressive medical school of today inaugurate such a program.

—*Continued from page 12.*

concise presentation — regarding a subject now so important in industrial medicine as to make *this* article's value inversely proportional to its brevity. « » THE editorial comments on "An Industrial Hygiene Division" and "Disabling Morbidity" leave little room for a note on the many interesting things to be found in the "Archives." « » DR. STORY'S article leads up to the question as to what his company's medical department has meant, and answers it (page 218) with figures and facts which are, to say the least, impressive and convincing. This was prepared under the sponsorship of Tufts College Medical School, and had first publication in *Industry*, the magazine of the Associated Industries of Massachusetts. « » THEN, upon a note of news,

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BIOLOGICAL PRODUCTS

by Dr. Louis Gershenfeld, P.D., B.Sc., Ph.M.

Professor of Bacteriology and Hygiene, Philadelphia College of Pharmacy and Science; Member of U. S. P. and N. F. Advisory Revision Committees; Consultant Author, etc.

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of which we hope to have more and more in successive issues, this issue comes to its close. « » Just in time to be here included comes the following from Dr. Andrew M. Harvey, *Dean Emeritus* of Industrial Medicine: "After reading the March issue of Industrial Medicine I wish to compliment you on this outstanding number. All of the articles are excellent, and give testimony that Industrial Medicine is unrivalled in its field of Medical Journalism. The program for the annual meeting of the American Association of Industrial Physicians and Surgeons is noteworthy in that it is furnished by young men who have attained eminence in their specialized work — who have developed in and with a department of medicine which only a few of the pioneers in industrial practice visioned as an important specialty when they organized the Society 25 years ago. In speaking of the industrial practitioner it is not out of place to note that his advice lengthens the active and gainful years of labor; he persuades management to more fully recognize the worth of the man on the job; he teaches society to consider the welfare of all who toil. The record is one of humane achievement. The magazine Industrial Medicine brings these truths to the general practitioner and widens his field of usefulness." Thank you, Dr. Harvey!

Industrial Nurses

THE Industrial Nurses' organization, Northwest District, Indiana, held their monthly meeting at the Lake Hills Country Club, St. Johns, Indiana on March 18, 1940. Fifty members and guests were present. The speaker was Dr. E. C. Holmblad, Regional Chief Surgeon, Railway Express Agency, and Consultant in Industrial Medicine and Surgery. Dr. Holmblad discussed the growth of the field of industrial nursing and some of the problems that occur in this process of development. Practical instructive experiences were related for their educational value and principles for guidance in various problems were suggested. These meetings are held monthly and are attended by officials of the various industries in this region. The speakers select topics which are of interest to both the nurses and representatives of industries. Members of the Industrial Nurses' organization are graduate and registered nurses, either connected with an industry or an industrial physician's office. The organization is under the direct supervision of an Advisory Board whose members at present are: Mr. Charles W. Stiles, Chairman, Manager, Industrial Relations, Carbide and Carbon Chemical Corporation, Whiting, Indiana; Dr. N. K. Forster, Hammond, Indiana; Dr. E. J. Shaeffer, General Manager, Whiting Plant, Standard Oil Company; Dr. A. J. Kammer, Inland Steel Co., Indiana Harbor, Indiana; Mr. Charles Reed, Attorney, East Chicago, Indiana; Mr. R. W. Fuhrhop, Industrial Relations Department, Shell Oil Co., Hammond, Indiana; Mr. A. Beckman, Superintendent, Borden-Wieland Division, Hammond, Indiana; Dr. H. G. Cole, Hammond, Indiana; Miss Inez Olson, president of the organization, industrial nurse at Continental Roll & Steel Foundry Company, East Chicago, Indiana; Miss Florence Carroll, secretary, industrial nurse at Youngstown Sheet & Tube Company, Indiana Harbor, Indiana; Miss Victoria Stalko, industrial nurse, American Maize Products Company, and Miss Betty Evancho, industrial nurse, Lever Bros. Company, both in Hammond, Indiana.

News

ON April 17, 1940, Dr. Joseph H. Chivers is to be the evening speaker before the Industrial Relations Club of St. Louis. His talk will evaluate the Medical Department from the Personnel and Industrial Relations viewpoint. Dr. Chivers is especially qualified to discuss this subject, having been a member of the Medical Department of Crane Company from 1920 to 1934; Director of Personnel for Crane Company from 1934 to 1936; and since 1936 Medical Director of Crane Company, with offices in Chicago.

AMONG the Californians who 25 years ago became members at the organization meeting of The American Industrial Physicians and Surgeons at Detroit in 1915 are the following:

Dr. Robert T. Legge, Professor of Hygiene and Lecturer in Industrial Medicine at the University of California at Berkeley. Dr. Legge was elected the First Vice-President.

Dr. Philip K. Brown, of San Francisco, Chief of the Medical Service which he organized at the Southern Pacific Railroad Hospital. Dr. Brown retiring this Spring.

Dr. Charles A. Dukes, of Oakland, California, formerly Surgeon for the Standard Oil Company at Richmond and who is now President of the California State Medical Association.

And Dr. Alvin Powell, at one time with the Western Pacific Railroad, who now resides at Lafayette, California, and is Lecturer in Health Education at the University of California at Berkeley, California.

Dr. John P. Russell is the Chief of the recently organized Division of Industrial Hygiene of the California State Board of Health, with headquarters and laboratories at Berkeley, California. He recently published an Industrial Survey of the San Francisco dry cleaning establishment. Fred R. Ingram and Earl W. Dakan are the engineers associated with the Industrial Hygiene Service of the State Board of Health.

Dr. Harry G. Ford, of Richmond, California, has been appointed Surgeon for the Standard Oil Company's plant in that city. Dr. Ford was formerly a Major in the U. S. A.

The Extension Department of the University of California provided a course of instruction in Industrial Hygiene for Industrial Nurses beginning on March 6. The course consists of lectures and demonstrations in industrial hygiene, two hours weekly, for 15 weeks. Fifty-two graduate industrial nurses registered. The instructor in charge is Professor Robert T. Legge.

Meetings

THE West Virginia Society of Industrial Physicians and Surgeons are meeting, April 9-10, in Charleston, West Virginia. Dr. Sumner L. Koch, of Chicago, is the guest speaker. One meeting is a joint session with the Kanawha Medical Society, at which Dr. Koch will discuss "Treatment of Recent Injuries."

THE Association of Surgeons of the Southern Railway, meeting at Charleston, South Carolina on June 4, 5, and 6, 1940, will have headquarters at the Fort Sumter Hotel. The Program Committee consists of: Dr. Edward T. Newell, Chattanooga, Tennessee (Chairman) Dr. James F. Mitchell, Washington, D. C., and Dr. L. F. Jackson, Jasper, Alabama.

Miscellaneous

Cleveland. March 16.— (AP) — Dosage of vitamin A to workers is saving money for Westinghouse Electric, the chief inspector of the company's Mansfield (Ohio) plant said today. Savings on electric ranges alone are more than $5,000 a year, Ralph F. Bisbee asserted in an address here. He reported results of 30 months' operation under the vitamin plan. Vitamin A regenerates visual purple, which is vital to the process of seeing. To those found deficient in the vitamin Westinghouse administers carotene in oil. The result is better eyesight — rejects due to off-color parts on the Mansfield assembly lines have been reduced to one fifth of what they were before launching of this therapy.—*Chicago Daily News.*

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INDUSTRIAL HYGIENE SECTION

This Industrial Hygiene Section is published to promote sound thought upon and concerning industrial hygiene. To that end it will contain articles, discussions, news items, reports, digests, and other presentations, together with editorial comments. The editorial policy is to encourage frank discussion. On this basis contributions are invited.

Industrial Medicine

Reg. U. S. Pat. Off.

The Editorial Committee will exercise its best judgment in selecting for publication the material which presents most exactly the factors affecting industrial health and developments for control of potentially injurious exposures. The editors may not concur in opinions expressed by the authors but will endeavor to assure authenticity of fact.

The Science, the Law and the Economics of Industrial Health

Volume 1 **APRIL, 1940** **Section 2**

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OFFICIAL PUBLICATION of the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION, W. P. YANT, Pittsburgh, Pa., *President;* WARREN A. COOK, Chicago, Ill., *President-Elect;* GORDON C. HARROLD, Detroit, Mich., *Secretary-Treasurer.*

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[The EDITORIAL COMMITTEE is not yet entirely complete as to personnel. The names of the additional members appointed from time to time will be announced in the issue of this *Industrial Hygiene Section* next following.]

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Engineering and Medicine

THE successful practice of industrial hygiene and medicine demands as nowhere else, the active and constructive coordination of engineering and medical principles. As DR. KENNETH D. SMITH has stated it: "Industrial hygiene may be paraphrased as the science of teamwork."

Industrial hygiene engineering concerns itself very largely with the fundamental principles of evaluation of industrial exposures and the devising of methods to control such exposures at their source if possible. The practical application of these fundamentals involves special techniques derived from the basic sciences of physics and chemistry; these sciences are also used in the practice of medicine, but in altogether different relationships. The engineer deals essentially with inanimate things and the laws governing them.

The industrial physician, schooled as he has been for years in the interpretation of pathological changes, is interested primarily in the evaluation of the effects of industrial exposures. His, therefore, is the realm of diagnosis, prognosis and treatment. He is also concerned with etiology, but in the past much more so in non-occupational diseases than in those of the occupational variety —apparently for the reason that the latter demand more of the engineering aspects.

It is unreasonable to believe that it will be possible to develop, in our generation at least, a sufficient number of persons who have had thorough training both in engineering and in medicine, applicable to industrial hygiene practice. There are a few instances of where industrial hygiene engineers have taken medical degrees, and a number of examples of medical men who have superimposed upon their medical training a substantial and practical amount of training in industrial hygiene principles — but these are in the minority.

A meeting ground common to both industrial hygiene and industrial medicine is the field of prevention; industrial hygiene may be rightly called the science of prevention and control of

occupational diseases, to which has been lately added the promotion of industrial health as such, industrial hygiene is a form of public health activity.

There is thus presented to practitioners in industrial medicine and hygiene the necessity of "bridging over" the two fields of medicine and engineering and the establishment of workable and reciprocal relationships. While the engineer cannot be expected to make diagnoses, which is essentially the prerogative of the physician, he may more and more frequently point out the etiological foundations on which sound diagnostic principles can be predicated, in much the same fashion as clinical laboratory technicians and other technicians function.

Similarly, the successful industrial physician of the future must better understand and assess the part which the working environment plays as an actuating factor of ill health and disease.

Industrial hygiene engineering, like any other young and growing science, is passing through an evolutionary and revolutionary period with respect to standards of practice. Medicine and engineering have passed through such periods and the lessons learned may be applied and adapted to industrial hygiene engineering.

The meeting of the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION with the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS is a real stride toward the establishment of practical reciprocal relationships between engineer and physician with the view of the ultimate achievement of the highest possible correlation of their activities in industrial hygiene.

Industrial Medicine and Hygiene

—*Conference Sponsored by the University of Michigan, Ann Arbor, January, 1940*—

C. O. SAPPINGTON, M.D., Dr.P.H.

AN IMPORTANT development in graduate and postgraduate education in industrial medicine and hygiene was reflected in the papers and discussions of the conference on this subject sponsored by the University of Michigan, Ann Arbor, January 11, 12 and 13, 1940.

Although the conference was originally intended as a seminar for students of the School of Public Health of the University of Michigan, it afforded an opportunity to physicians, hygienists, industrialists, and others to hear discussions on many phases of industrial medicine and hygiene.

JOHN SUNDWALL, M.D., was General Chairman of the conference. The Program follows:

Thursday, January 11: 9:00 to 12:00 A.M.

CHAIRMAN OF THE SESSION: HENRY COOK, M.D., Chairman of Committee on Occupational Diseases and Industrial Hygiene, Michigan State Medical Society, Past President, Michigan State Medical Society.

SALUTATION: JAMES D. BRUCE, M.D., Vice-President of the University, Chairman Division of Health Sciences, Director Department of Post-Graduate Medicine.

"Health Problems in Industry"—J. J. BLOOMFIELD, Sanitary Engineer, Division of Industrial Hygiene, United States Public Health Service.

"Industrial Health and the Physician"—ANTHONY J. LANZA, M.D., Assistant Director, Welfare Division, Metropolitan Life Insurance Company.

"Coordination of Industrial Hygiene with Other Health Agencies in the Community"—KENNETH E. MARKUSON, M.D., Director of the Bureau of Industrial Hygiene, Michigan Department of Health.

Thursday, January 11: 2:00 to 5:00 P.M.

CHAIRMAN OF THE SESSION: C. D. SELBY, M.D., Medical Consultant, General Motors Corporation, Detroit.

"Studies in Industrial Hygiene"—J. J. BLOOMFIELD.

A. Preliminary Survey.

B. Dust as Applied to Pneumoconiosis.

C. Pneumonia in Industry.

"Industrial Dermatoses"—GEORGE VAN RHEE, M.D., Committee on Occupational Diseases and Industrial Hygiene, Michigan State Medical Society.

DINNER 6:00 P.M.—Michigan Union. E. W. SINK, M.D., presiding.

"Medicolegal Phases of Occupational Diseases"—C. O. SAPPINGTON, M.D., Dr.P.H., Consulting Industrial Hygienist, Chicago, Illinois.

Friday, January 12: 9:00 to 12:00 A.M.

CHAIRMAN OF THE SESSION: JOHN J. PRENDERGAST, M.D., Medical Director, Chrysler Corporation.

"Studies in Industrial Hygiene" (continued)—J. J. BLOOMFIELD.

A. Lead Poisoning.

B. Chromium Poisoning.

C. Mercury Poisoning.

"Exhaust Ventilation"—WILLIAM N. WITHERIDGE, Ventilation Engineer, Bureau of Industrial Hygiene, Detroit Department of Health.

Friday, January 12: 2:00 to 5:00 P.M.

CHAIRMAN OF THE SESSION: ROBERT H. DENHAM, M.D., President, Michigan Society of Industrial Physicians and Surgeons.

"Control of Industrial Hazards"—J. J. BLOOMFIELD.

"Integration of Industrial Hygiene with Industrial Medicine"—H. G. DYKTOR, BSCE, Industrial Hygiene Engineer, Bureau of Industrial Hygiene, Michigan Department of Health.

"Demonstration of Field Instruments Utilized in Industrial Hygiene"—WILLIAM G. FREDRICK, Sc.D., and HERBERT WALWORTH, M.S.E., Bureau of Industrial Hygiene, Detroit Department of Health.

DINNER 6:00 P.M.—Michigan Union—HARRY E. MILLER, BSCE, presiding.

"Industrial Hygiene Administration and Industrial Legislation"—J. J. BLOOMFIELD.

Saturday, January 13: 9:00 to 12:00 A.M.

CHAIRMAN OF THE SESSION: KENNETH E. MARKUSON, M.D., Director, Bureau of Industrial Hygiene, Michigan Department of Health.

"Development and Practice of Industrial Hygiene in State and Local Health Departments"—J. J. BLOOMFIELD.

"State Industrial Hygiene Surveys"—LOUIS SPOLYAR, M.D., Chief, Bureau of Industrial Hygiene, Indiana State Board of Health.

"Function of State in the Control of Occupational Diseases"—KENNETH D. SMITH, M.D., Chief, Bureau of Occupational Diseases, Ohio Department of Health.

"Value of Records in Industry"—M. H. KRONENBERG, M.D., Chief, Division of Industrial Hygiene, Illinois Department of Public Health.

DR. JOHN SUNDWALL, in opening the conference, spoke of the diseases of miners, wrestlers and runners and also of lead poisoning,

all of which were well-known in ancient times. From Ramazzini we have the information that occupational medicine is the oldest branch of medicine. This phase of medical effort represents the cradle of modern medical-sociological trends. Industrial hygiene is one of the most outstanding parts and has come to be considered almost the synonym of adult hygiene.

DR. JAMES D. BRUCE commented, after welcoming the participants in the conference, on the fact that one difficulty had previously been somewhat of a division of interest in public health and medicine—this difficulty being now very largely overcome. There are other evidences that interest is being taken by state medical societies and university departments in public health procedures. It is very important that internships include such training and also that the opportunities for postgraduate education be provided in this field. The solution of the problem lies in bringing together the many different interests and groups and building a complete mosaic.

MR. J. J. BLOOMFIELD defined industrial hygiene as the science of the preservation of the health of workers. This involves primarily a program of health conservation and accident and occupational disease prevention and necessarily includes also the broad subject of the health of the worker.

In tracing the historical development of industrial medicine, the first chief function of such departments was the treatment of injuries; gradually the work extended to the medical phases; more recently, the medical and engineering control of occupational diseases, and now to the health of the individuals in employed groups.

There are various health indexes in employed groups which may be stated as follows: (1) minor defects causing discomfort and inefficiency, but not involving lost time; (2) physical and mental impairments of those at work; (3) illnesses causing inability to work, as measured by lost time; and (4) mortality.

Our concern as public health workers is chiefly with the preventive phase of the problem and the determination of what the health status of workers is like at the present time. Where these things are known, necessary corrective measures may be planned, evaluated and executed.

In estimating the present status of the health of workers, it is important to get information regarding industrial accidents, occupational diseases, physical defects experiences, and general morbidity and mortality. It is also necessary to consider the results of environmental and laboratory studies, which will be given in another lecture.

With respect to accidents, figures developed by the U. S. Bureau of Labor Statistics and by the National Safety Council show that during the 26 year period for which the record is available (1907 to the end of 1932), the number of accidents per million man-hours has been reduced 78%, while the time lost from accidents per million man-hours has been cut 68%. More recent figures show an annual death toll of 17,000 to 19,000, the most recent showing a drop of 11% in mortality. More compensable industrial accidents result from the handling of objects than occur in any other way.

There are little adequate data regarding occupational diseases which are reported in different states. Figures were quoted from the States of Ohio, Illinois and New York. Dermatitis leads all other types of occupational disease in frequency, with lead poisoning, tenosynovitis, carbon monoxide poisoning, and lung conditions being other chief causes. Occupational diseases account for but a small percentage of the total time lost from all types of disability.

Physical defect figures resulting from the examination of 10,000 men in the steel industry showed that of the 6100 old employees, 59% had no physical defects of any consequence and of the 3900 new applicants, 72% were found free from such defects. The most common types were dental defects, with visual difficulties and high blood pressure following in order.

In sickness surveys, it has been discovered that the respiratory diseases constitute 42.4% of the total illnesses, digestive diseases accounting for 13.5%, and external causes (non-industrial accidents), 9.8%. Furthermore, sickness accounts for 15 times as much lost time as accidents and occupational diseases combined. Other figures indicate that there is excessively high mortality in certain occupational pursuits, excessively high morbidity especially from degenerative diseases, and an excessive amount of physical impairment in certain occupations—which points the way for programs of control. Sickness in industry has been estimated to cost five billion dollars annually and the total bill for all types of disability for the entire nation, 10 billion dollars annually.

DR. C. D. SELBY spoke for Dr. A. J. Lanza on the subject "Industrial Health and the Physician." The importance of the physician in this type of work was emphasized. It should be kept in mind that the problem is not wholly one of physical examinations; there are other important considerations. A broad view was taken of the concept of industrial hygiene; it included all measures for the preservation of the health of the worker.

The formation of the American Industrial Hygiene Association was mentioned and its significance in the industrial health movement. The State of Michigan is in a particularly strategic position in the development of this field. It was pointed out that the general medical profession is not adequately prepared to take care of this work.

Of the 17,000 plants mentioned in the U. S. Public Health Service survey, 70% of the plants are found to be without medical service.

The danger in the promulgation of the so-called codes was discussed and it was pointed out that such codes should not be used arbitrarily.

Case-finding studies by physicians in industry are the most important phase of the work. This type of endeavor is gradually going over into the

health field and the evolution of the specialization in preventive medicine (not surgery) is so rapid that the profession does not sense it and the schools are just realizing it. The newer opportunities in this important field are now being developed.

DR. KENNETH E. MARKUSON presented the subject "Coordination of Industrial Hygiene with Other Health Agencies in the Community."

Any public health program must be integrated with community activities to be successful and this is most important in industrial hygiene programs. This involves, as previously stated, a complete adult health program.

An example was given of the examination of 400 employees in a garment manufacturing organization, the result being case-finding of 19 instances of tuberculosis. This was responsible for the institution of a program of pre-employment examinations in this group.

The importance of keeping in mind the possibility of cross connections in plumbing was emphasized as an example of preventive sanitation.

In the State of Michigan a central bureau was found to be inexpedient and therefore, units had been established at Detroit, Saginaw, Flint and Grand Rapids.

With reference to medical work, there are no curative procedures provided, but case-finding only is practiced.

Differences in reporting laws often give rise to confusion.

In the proper preparation of students, the cooperation of state medical societies can go a long way toward promoting efficiency.

The fact that 62% of plants employ less than 500 people shows the importance of providing adequate health service in such groups.

Some of the outstanding problems are lost time, placement, and chronic degenerative diseases. The latter is of especial importance when it is considered that the age incidence is rising in industry.

Better examinations will be necessary in the future, as well as control of environmental hazards.

Industrial hygiene constitutes a field which partakes of medicine, hygiene and general public health work and must be integrated with community health agencies if results are to be had.

DR. HENRY COOK, as chairman of the Committee on Occupational Diseases and Industrial Hygiene of the Michigan State Medical Society, commented on the activities of this group. The committee was especially interested at first in guiding legislation and next, in survey questionnaires as to what the problem really is. As to the education of the profession, the county society programs are to have speakers from time to time on appropriate subjects and postgraduate conferences have provided for one session. The program of the committee has been outlined to the Committee on Public Relations of the State Medical Society and thus will be conveyed to the various localities through local members.

DR. HENRY VAUGHAN, in completing the discussion, again emphasized that industrial hygiene is adult health work; that there must be coordination and cooperation of all agencies; that the agencies must be duly prepared; and that the viewpoint must be entirely unbiased.

Thursday Afternoon Session

MR. J. J. BLOOMFIELD presented a discussion of "Studies of Health Hazards in Industry," selecting as examples the studies on mercurialism in the hatters' fur cutting industry, studies in chrome plating and finally, on lead poisoning.

In industrial hygiene practice, the medical functions are concerned with personal hygiene, whereas the engineering functions are concerned with environmental hygiene. The term "industrial epidemiology" is used in connection with these studies as referring to methods used for the investigation of disease occurring in industry among industrial workers and the determination of methods of prevention or control of such disease.

The general classification of health hazards was given, making the large subdivisions of *chemical hazards* (poisons), *biological hazards* (infections), and *physical hazards* (including accidents caused by machinery, excessive humidity, heat and cold, defective illumination, repeated motion, shock, and abnormal atmospheric pressures).

The importance of preliminary surveys was emphasized and a brief outline given regarding these.

With reference to the mercurialism study, various survey forms were exhibited on lantern slides, as well as statistical tables with reference to the occurrence of exposures, disease, and methods of control. Thirty-six plants employing 2000 persons were involved, from which six representative plants were selected for detailed study after a preliminary analysis, of the general conditions. Included also in the preliminary survey was an occupational analysis of major occupations; the major occupational hazards were exposures to mercury vapor and dust. One hundred and twenty-four samples of vapor and dust were obtained in the study.

The medical studies showed that approximately 8% of all employees could be diagnosed as having chronic mercurialism.

It was established that an exposure of less than 2 milligrams per 10 cubic meters of air was allowable and that three methods were successful in diminishing exposures, namely segregation, local exhaust ventilation, and general natural ventilation, according to the type of occupation and process. A series of lantern slides illustrated the various types of chrome plating tanks used and also the method of slot ventilation to reduce the chromic acid vapor to less than one milligram per 10 cubic meters of air as the established allowable concentration. A series of photographs of different types of chrome lesions were also used to good effect in pointing out the results of exposure to high concentrations of vapor.

With reference to the lead study, a distinction was made between lead absorption and lead poisoning. In the study of the storage battery in-

dustry, a standard was made providing that atmospheric concentrations of lead dust or fumes should be less than 1.5 milligrams per 10 cubic meters of air. This standard was chosen after the study had disclosed that there was a close correlation between lead exposure in different departments of the plants and the risk of developing lead poisoning. For example, in the mixing department where there was an average of about 120 milligrams per 10 cubic meters of air, there was an appreciable risk even in the first month; in the pasting department where the exposure was 50 milligrams, there was a severe risk after the first month; and in the burning department with a concentration as high as 5.7 milligrams there was no appreciable risk until the fourth month.

DR. GEORGE VAN RHEE presented the subject of "Industrial Dermatoses."

Industrial dermatoses outrank all other occupational diseases from the standpoint of frequency. There are two general forms described, the so-called contact and the so-called sensitivity forms. This paper was based on experience with 185 cases in private practice during the past three years.

Lantern slides showed tabulations relative to incidence, duration, age, sex, location, and causes.

The age was mainly under 40 years; the sex was mostly male; in regard to duration, 65% of cases existed for four weeks and 82% existed for a period of six weeks; the parts of the body mainly affected were the hands and forearms; the chief causes were oil, grease, paints, and strong soaps; the employment range was from two weeks to 40 years with so-called "pile-ups" in the statistical frequency at one, two and six year periods.

The patch test is of value in the diagnosis of industrial dermatoses only when carefully done and intelligently interpreted. It is of great importance to correlate the past history and industrial history.

Preventive measures involve (1) personal hygiene at home and in the shop (particularly with reference to cleansing agents); (2) the replacement of manual processes by mechanical ones and where this cannot be done, the proper use of gloves; (3) the education of employees; (4) the change of working clothes daily, especially by those who have oily skins; and (5) early recognition of industrial cases.

In closing, the speaker emphasized especially the necessity for the provision of means for the rehabilitation of persons having chronic industrial dermatoses, through training in new trades, where hazards do not exist.

Dinner Meeting

DR. C. O. SAPPINGTON spoke on "Medicolegal Phases of Occupational Diseases."

The material was divided into three parts, industrial, medical, and compensation experience. Lantern slides were shown depicting various types of industrial hygiene apparatus and methods in the evaluation of environmental exposures. Reference was made to the Wisconsin plan of physical examinations and also typical x-ray photographs of silicotic and non-silicotic cases were exhibited.

With reference to compensation experience, figures were given from New York, Ohio, Illinois, and Wisconsin. These figures showed that occupational disease cases are on the increase in states where figures are available, and furthermore that the cost of such cases is increasing; especially interesting figures were quoted from the Wisconsin experience relative to the cost of silicosis cases, particularly the cost of compensation alone. These figures definitely showed that silicosis is among the most costly (with reference to compensation only) even when compared with the major types of disability resulting from accidents. A recently revised map showed that 21 states now make some type of provision for occupational disease coverage. The presentation concluded with a new classification of medicolegal typing of occupational disease cases, with four case histories.

Friday Morning Session

MR. BLOOMFIELD presented a discussion of dust problems, and later, as an example of a biological hazard, a discussion of pneumonia in industry.

The U. S. Public Health Service began its study of the health of workers in dusty trades in 1914 in the mines of Joplin, Missouri. Later on, investigations were made with reference to the health of workers exposed to dust in cement plants, in the granite cutting industry, in anthracite and bituminous coal mining, in a silverware polishing plant, in cotton cloth manufacturing, and municipal street sweeping. Later, shorter and more intensive studies were conducted in slate, granite, marble and talc quarries and more recently, rather extensive studies of the health of anthracite coal workers, asbestos workers, and pottery manufacturing groups were completed.

In these studies, examinations were made to determine the general physical condition of the workers; special examinations were conducted to determine the prevalence of diseases of the respiratory system resulting particularly from exposure to dust hazards; the records were made of the nature and severity of disabling illnesses; and analysis and detailed study were made of the occupational environment; occupational mortality statistics relating to the specific dust were considered; and finally, autopsy material as available was used.

Especial emphasis was laid on the importance of proper interpretation of results. Dust determinations served three purposes: to make it possible to evaluate the extent of the hazard—they can be correlated to clinical studies—and lastly, they can be used to control the hazard through the study of the efficiency of the protective devices.

Through the aforementioned studies, it was possible to set up certain allowable concentrations of dust in the different types of industries involved and furthermore, it was also possible to develop and suggest various methods of protection such as plant design and renovation; housekeeping and maintenance; methods of ventilation and dust control; wet methods; personal respiratory protective devices; and determination of concentration and character of dust.

The Public Health Service has also conducted from time to time various studies relating to illness in industry, pneumonia in the steel industry being an example of this. It was found, for instance, that during the period 1922-1928 the pneumonia case rate in the steel industry was nearly 70% higher than the rate in public utilities and approximately 50% higher than the rate for a group of other reporting industries. Accordingly, the rates for pneumonia were studied in various occupations and departments which showed among other things that the disease was associated with exposure to heat hazards, when subjection to wide changes in temperature was involved; also with outdoor exposure to inclement weather and with indoor exposure to humid, drafty conditions and wet clothing. Sudden cooling or chilling of the body was indicated as an important predisposing factor. As a result of the investigation, several remedial measures were suggested: (1) mechanical devices for the reduction of the heat hazard in occupations involving exposure to radiant energy; (2) further mechanization of processes involving heat hazards thus reducing exposure; (3) adequate provision for change houses; (4) provision for shelters for outdoor workers in stormy weather; (5) suggestion of a stagger system for reduction of hours of work, especially during winter months; (6) health education for employees with proper instruction regarding personal hygiene; (7) a visiting nursing service during incipient stages of illness, possibly as a part of employee sick-benefit organization or through the local public health nursing organization; and (8) the gauging of effectiveness of measures by sickness and mortality rates, preferably over five years.

MR. WILLIAM N. WITHERIDGE spoke on "Exhaust Ventilation." Reference was particularly made in the beginning of this talk to the monograph by Dalla Valle on "Principles of Exhaust Design," as being a very excellent treatise.

There is a fundamental difference between ventilation and air conditioning and this should be well understood by those who are attempting any work of this sort. The usual basis for speaking about how ventilating is done, is usually expressed in terms of air changes per minute. It is possible to handle vapors with a smaller velocity than dusts (50 feet per minute as opposed to 500 feet per minute at the face). The velocity in a closed system of ventilation needs to be fairly high to prevent settling, but the velocity of suction versus blowing is not readily apparent. There are voluminous data on pipe designs, but little standard information on hoods, because of their variability.

Air cleaning apparatus is a constant source of expense and worry because of the particular design of this type of device.

Electrical precipitation, filtration, washing, cyclone apparatus, and settling chambers apply to other methods of handling dust. Filtering efficiency is measured in terms of resistance, commonly expressed in inches of water. But a filtering system should not be judged on the percentage of its efficiency alone.

Fans of propeller type should not be attached to more than 30 feet of pipe. Blowers should be used and the centrifugal blower type is the most expensive, but the best. A discussion of metals and coatings was given in reference to the selection of materials for piping.

Finally, it was emphasized that ventilation systems should be studied in both winter and summer, in order to get the data for sound conclusions.

Friday Afternoon Session

MR. BLOOMFIELD'S next subject was "The Control of Industrial Health Hazards."

There are two types of control, medical control and engineering control.

Medical control is largely exerted through an industrial health service, the objects of which are to ascertain physical and mental fitness for work; maintain health of those already employed; to educate the worker in accident prevention and personal hygiene; and to reduce lost time and absenteeism from illness or injury. Some of the means by which these objectives are obtained are through pre-employment and periodic examinations; standardization of methods of examinations and records; the diagnosis and treatment of industrial injuries and diseases; first aid instruction; dispensary service; medical and hospital service outside of industrial groups; home visits; and medical records.

In general, the methods found of value in engineering control may be mentioned as (1) substitution; (2) isolation; (3) wet methods; (4) local exhaust ventilation; and (5) respiratory protection. Substitution, although not extensively used, has found application where it is possible to use non-siliceous substances instead of those containing a considerable amount of free silica; an example is the employment of a metallic abrasive instead of sand.

Isolation or mechanical inclosure of certain processes, has found considerable application in the control of certain kinds of toxic materials. This may be applied either to dusty processes, or where gases and vapors are involved.

Wet methods are limited entirely to dust-producing processes and as an example of this, in rock-drilling it has been found possible to reduce dust concentrations from more than five hundred million particles to less than 30 million particles after using wet methods in these operations.

Local exhaust ventilation has been designated as a primary method of control, since it can remove dust, fumes, vapors or gases at the source. A great deal depends upon the correct design and construction of hoods and exhaust systems, so that it takes considerable care to lay out such systems and further care to see that they are maintained in proper operating condition. As examples, spray-painting booths require velocities of 100 to 200 feet per minute at the openings to reduce the concentration of vapors to safe limits; in use of laterally exhausted chromium plating tanks, studies have shown that air velocities are about 2000 feet per minute and hood openings are necessary for effective control of chromic acid vapors; in granite-cutting sheds

with hoods placed near cutting machines, the studies of the Public Health Service have indicated that 1500 feet per minute at hood openings would keep dust concentrations within safe limits.

Respiratory protection will always be required either as a primary means of protection or as an adjunct to other preventive procedures, because there will always be situations where it is impossible to prevent contamination of the air in the breathing zone by other methods alone. Within recent years great improvement of respiratory protective devices has been made, and with the approval system of the U. S. Bureau of Mines, further research has been stimulated on the part of manufacturers, resulting in better products.

Important steps are still to be taken in the study of new types of chemical compounds as to possible toxic effects, calling for close collaboration between the production and development departments and the industrial health maintenance service. Even with the most efficient methods of control, it is still essential for the medical, nursing, and engineering personnel to maintain constant vigilance to keep untoward results at a minimum.

MR. H. G. DYKTOR presented the subject "Integration of Industrial Hygiene with Industrial Medicine." This paper was a discussion of the integration of the work of the official industrial hygiene unit with the plant medical unit.

The services of the industrial hygiene unit may be mentioned as follows: (1) specific tests, studies and surveys; (2) information on harmful conditions; (3) comparative statistics on similar plants; (4) interpretation of industrial hygiene statistics; (5) correlation of work in different plants for the sake of uniformity; (6) working through the plant medical units to obtain good housekeeping and sanitation procedures; (7) stimulation of preventive activities, and (8) stimulation of interest in the life of the worker outside of the plant.

Among others, the functions of the plant medical unit are: (1) a sincere desire to improve the health of the worker; (2) the support of the industrial hygiene unit in educational programs; (3) supplying of industrial hygiene units with absenteeism records for study; (4) advising the industrial hygiene unit of experience in prevention and control measures; (5) supporting the industrial hygiene unit in obtaining improvement in conditions; and (6) cooperation regarding the interpretation of industrial hygiene on a broad basis, providing for the extension of principles of healthful living outside of industry, leading toward the improvement of general living conditions in the community.

It can thus be seen that a great deal can be accomplished by the use of cooperation and coordination of effort upon the part of the official industrial hygiene unit and the plant medical unit, and most important of all, it is emphasized that this coordination and cooperation of effort is vital to successful results.

DR. WILLIAM G. FREDRICK and MR. HERBERT WALWORTH gave a demonstration of field instruments utilized in industrial hygiene.

DR. FREDRICK first commented on the general phases of the measurement and evaluation of exposure, involving laboratory and field procedures. Field equipment was demonstrated for the sampling of gases and vapors, dust, and the measurement of illumination and radiation, as well as the estimation of certain physical elements with regard to the atmosphere.

The following types of apparatus were demonstrated: (1) halide lamp for qualitative testing of halogenated hydrocarbons; (2) quantitative apparatus for the measurement of halogenated hydrocarbons; (3) continuous carbon monoxide indicator; (4) combustion gas indicator; (5) spiral gas washing bottle; (6) gas bubbler with plate; (7) vane velometer and Pitot tube; (8) thermal anemometer; (9) smoke tube for direction of air flow and smoke candles; (10) katathermometer; (11) sling psychrometer; (12) pyrometer for measuring temperature of molten metals; (13) illuminometers; (14) electrostatic precipitator; (15) dust impingers (large type and midget types); (16) B. & L. dust counter; and (17) Zeiss konimeter. With the demonstration of these various types of apparatus, DR. FREDRICK gave interesting descriptions as to the use of the devices, and commented on the fact that the instruments must be very carefully calibrated and used to get accurate results.

Dinner Session, Friday

MR. BLOOMFIELD spoke at this session on "Present Industrial Hygiene Practices."

During the past four years there has been rapid growth in the establishment of industrial hygiene units in health departments of the various states. It has been realized, however, that a cooperative program among the various agencies is needed and that each state should develop a program to meet its own existing laws and conditions.

Cooperating branches of the Federal government engaged in this field are the Department of Labor, U. S. Bureau of Mines, and the U. S. Public Health Service. The activities of the latter include cooperative services in investigations, involving laboratory studies, the development of apparatus and methods, field investigations, including statistical investigations, exposure studies, and others, and finally the development of industrial hygiene services in the state and local health agencies with the study of the facilities and needs of industry.

It is apparent at the present time that most state industrial hygiene units employ a relatively small number of persons, and it is, therefore, evident that even if this number of persons was doubled, one could only hope to accomplish a limited improvement in the health of the gainfully employed persons in any state unless all of the resources of the health department could be drafted. Although some states have only a small number of so-called industrial workers, industrial hygiene activities through health departments can be applied in carrying on a program of nutrition, venereal disease, tuberculosis, and other disease control through industrial groups. Furthermore through industry as

a medium, investigations could be carried on relative to the occurrence of chronic diseases and permanent impairment, through the supervision of the health departments of the states, since it is through these impairments and diseases that the six of the 10 days of incapacity from illness and accidents are experienced by the average person in a year.

It can thus be seen that industrial hygiene units can aid the medical profession in assisting in the diagnosis of industrial diseases and in cooperating in general with public health services through the health department of the state, by extending facilities for communicable disease control, the study of other preventable diseases, rehabilitation, dental hygiene, nutrition, mental hygiene, laboratory services of all types, statistical services in connection with morbidity reporting, nursing services, in connection with follow-up work, and public health education.

The environmental hygiene aspects concern themselves, as previously outlined with removal and control of air contaminants, ventilation, illumination, general sanitation, water supply, sewage disposal, fire protection, accident control, industrial waste disposal, cross-connection elimination, milk and other foods, control of home and recreational environments, housing, swimming pool sanitation, and control of insect-borne diseases.

The benefits of industrial hygiene may be of two varieties—intangible and tangible. The former are noticed through improved industrial relations, improved public relations, and humanitarian aspects. The tangible benefits are to be derived through improved health and resulting improved efficiency of production and decrease in spoilage, as well as cash benefits which are reflected in lower taxes, due to decrease in relief expenditures, and lowered compensation costs.

In completing this presentation, Mr. Bloomfield gave illustrative examples of various concerns where money was actually saved by industrial hygiene programs.

Saturday Morning Session

AT THE beginning of this meeting, MR. WILLIAM R. BRADLEY, the Secretary of the Michigan Industrial Hygiene Society, made a general statement regarding the formation of this society as a part of the American Industrial Hygiene Association, which was previously formed at the June meeting of the American Association of Industrial Physicians and Surgeons at Cleveland, in 1939.

MR. BLOOMFIELD completed his series of lectures by a review of industrial legislation and workmen's compensation in the United States.

In the beginning, industrial groups were small and machinery was little known and used. However, with the advent of the industrial revolution in the late 18th century, there was considerable increase in the number of employees in workshops, which caused the gradual disappearance of the social relationship between employer and employee, and furthermore, an increase in the number of accidents and diseases of occupation occurred. It was because of these developments that laws were formulated providing a remedy for the resulting disability and the decrease or disappearance of earning capacity.

Beginning in 1909, laws were passed in the various states with reference to accidental injuries. The earliest occupational disease laws passed in this country were for the United States Civil employees in 1908 and the law in New Jersey in 1911. At present, 23 states provide compensation for one or more occupational diseases. In the remainder of the states the occupational diseases are excluded from compensation by language of the act, by interpretation of the courts or otherwise.

Three types of laws exist with reference to occupational disease compensation: (1) general coverage; (2) limited coverage, in which the diseases are named; and (3) those using the word "injury" instead of "accident." Laws are further subdivided, with respect to limited coverage, as follows: (1) those limited to specific diseases and specific processes; (2) those limited to specific diseases; (3) those limited to specific processes; and (4) those limited to specific industries.

There seems to be a healthy trend in forming laws, because the advice of the U. S. Public Health Service is now asked on the type and extent of provisions which should be made; this decision depends on the kind of exposures in the industries in the states involved.

Previous objections to such laws providing for occupational disease compensation were that the inclusion of occupational diseases would involve difficulties of diagnosis and might add greatly to the cost of the system. However, experience in states which have had such laws indicates that this statement has not been confirmed.

In general, there is lack of provision for preventive measures in the statutes with the exception of some certain states, such as Maryland and Idaho which have provided for the establishment of industrial hygiene units, in the laws.

DR. LOUIS SPOLYAR spoke on "State Industrial Hygiene Surveys."

In general, surveys are limited according to time, money, personnel and need. Analytical guidance is vital, so that the proper use may be made of the results of such surveys. From such surveys come values, such as information as to the type of problems to be encountered, the training of new personnel, and the relationship of suspected hazards to actual ones; the necessity for protection, where such protection has not been previously given; and the development of information partciularly with regard to trade names. In addition to this, medical, welfare and sanitation data can be developed and be of invaluable assistance to the employer.

Specifically, the services rendered through industrial hygiene surveys should (1) indicate hazards; (2) emphasize the interrelationship of medical and engineering services; (3) indicate the need for special examinations and studies; (4) develop the need and methods of recording data in

industry; (5) point the way for sanitation programs; (6) show the possibilities and the need for teaching outside groups; and (7) indicate the need for limited types of research.

In closing, it was emphasized that the small plants are those which will benefit to a greater degree by the proper application of industrial hygiene services.

DR. M. H. KRONENBERG spoke on "Value of Records in Industry." Statistics are the only real basis for accomplishment in industrial programs and further, constitute a measure of the effectiveness of preventive procedures which are economically sound for people and for profit.

The approach to industry through absenteeism records makes possible the reduction of the frequency of illness and the reduction of the severity of illness. A number of illustrations were cited as to the values of an advisory service in industry to employees, one example being given of where an employee was using a liniment for gall-bladder trouble.

Losses through sickness absenteeism really constitute a sickness of industry and such losses are not controllable like taxes. In one survey it was found that 82% of the sickness absenteeism was caused by 18% of the employees, thus indicating a place for special study. Studies on absenteeism made, for example, by the Portland Cement Association afford excellent data for comparison.

Case-finding is an important phase of the application of records in industry; for example, two cases of cancer of the cervix were discovered in 600 female employees and eight cases of tuberculosis in 3100 employees.

Lantern slides were used to illustrate various experiences and also different forms for cumulative absenteeism records.

DR. KENNETH D. SMITH concluded the program with a brief and informal presentation of the subject "Function of the State in the Control of Occupational Diseases."

The economic principles involved in the control of occupational diseases are most important to taxpayers, employers and workers.

There are several approaches, among which may be mentioned legislative (an example of which is the prohibition of the use of white phosphorus in manufacturing processes); the regulation and control of industrial hazards; and compensation and insurance phases.

There are very definite parallels in child and maternal hygiene, which may be very well adapted in industrial hygiene.

Industrial hygiene may be paraphrased as the science of teamwork.

The differences now occurring in life expectancy after the age of 50 have greatly altered our point of view with respect to industrial employees and the health approach.

The broad concept of industrial hygiene is the one which should certainly be used, extending the phases of this type of work to adult health education.

Legislation is obviously not the solution of our difficulties, but education is. The people should be educated and informed as to the rudiments, the costs and the benefits; the medical profession should be educated, particularly with reference to occupational histories in case reports; the nurse and management also need to be educated along specific lines.

More use should be made of case histories in our work and also greater emphasis should be placed on the importance and the significance of employee-employer conferences.

Visibility and Ease of Seeing

Matthew Luckiesh *and* Frank K. Moss,
Lighting Research Laboratory,
General Electric Company,
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IT IS a reasonable assumption that if it were not for the predominance of critical and prolonged near-vision in civilized communities, there would be much less need for refined conditions for seeing and for precise corrections of refractive abnormalities. In considering the severity of near-vision tasks, certain data pertaining to visual functions while reading are appropriate for quantitative analysis. For example, the average adult may read more than 10,000 four-inch lines of print during an eight-hour period. This is equivalent to reading nearly a mile of printed matter. In performing this task, the eyes may be required to make nearly 100,000 fixational pauses. If one step in walking is compared to one fixational step in reading, it follows that one would be required to walk over 30 miles per eight-hour day in order to keep pace with the eye movements. This comparison is significant if it is assumed that the musculatures of the eyes and legs are proportionately capable of performing their respective functions.

The severity of critical near-vision tasks, such as reading, is also suggested by the frequency of involuntary blinking as well as by various other physiological phenomena. For example, a reader possessing normal vision and reading under favorable conditions may blink 3000 times during an eight-hour period. However, some persons blink at ten times this rate or 30,000 times during the eight-hour period, and all subjects blink at a faster rate as the period of reading is prolonged. The causation of these movements of the eyelids is attributed to numerous factors including those of moistening the cornea and washing it free from foreign matter. However, it has been stated[1] that one of the reasons for blinking is to alter the tension of the extrinsic ocular muscles(the eyes turn upwards during blinking) in order to prevent early fatigue. On this basis, thousands of "respites" from critical near-vision are obtained as a result of blinking by those engaged in prolonged visual work such as reading.

These phenomena associated with near-vision tasks are advanced as a matter of interest and to

emphasize the apparent severity of such tasks. Obviously, these data are not regarded as scientifically acceptable appraisals of the difficulty of the task or as bases for estimating the development of ocular and general "fatigue." However, techniques for these purposes are discussed briefly herein and in detail elsewhere.[2]

Thresholds and Supra-Thresholds of Seeing

ALTHOUGH the degree of fatigue induced by a given visual task is not now measurable in absolute terms, it may be regarded as axiomatic that fatigue is reduced when the conditions for seeing are improved. Thus measurements of the visibility of objects[3] or the visual efficiency of the observer may serve as measures of the relative degree of fatigue which may be induced by the performance of visual tasks under various conditions for seeing. In brief, visibility, ease of seeing and visual fatigue are intimately related. Furthermore, the attribute of visibility is the controllable factor in all situations and, as such, it is of maximal practical importance. In general, we are now certain that maximal ease of seeing is associated with maximal visibility, although this does not imply that the methods by which maximal visibility are obtained are unimportant. Thus from the viewpoint of the welfare of workers performing the tasks of critical seeing, the determination of the degree of fatigue is only of academic interest unless some means are available by which fatigue may be minimized.

In Fig. 1 are shown four thresholds of visibility and two supra-thresholds involving performance and ease in seeing, respectively. Five of them can be definitely established by measurement for a specific visual object or task seen or performed by a specific observer (or an average of group) under specific conditions. Supra-threshold *A* has not been definitely established for any task owing to the necessity of measuring and integrating the many effects of seeing upon the human being. However, much has been learned about this relatively new objective revealed through psychophysiological researches[2] during the past decade, particularly for the task of reading. We know that this supra-threshold is far above the four thresholds of visibility. Suprathreshold *B* is generally below *A*. No particular stress is given to the relative locations or spacing of these thresholds in Fig. 1. They are presented in this manner merely for visualization while describing them in the paragraphs which follow. In considering thresholds *C*, *D*, *E* and *F*, it is sufficient to realize that if an object or task is just at a given thresold due to a certain combination of visual factors or seeing conditions it may be raised above this threshold by a greater utilization of one or more aids to seeing, or by lessening the effect of one or more hindrances which may be present. Likewise, the object or task may be lowered below this threshold by lessening the utilization of aids or by increasing the effects of hindrances.

A. MAXIMAL EASE OF SEEING: This is a supra-threshold determined by human behavior and by minimization of the costs of seeing to the human being. It represents the optimum of conservation of human resources. This desirable maximum is attained when seeing conditions exact the minimum cost from the human being operating as a human seeing-machine. Present indications are that this ideal condition is reached, for example, for the task of reading 10-point or 12-point type well-printed upon non-glossy, white paper if the level of illumination is somewhere above 100 footcandles. For tasks such as sewing, where the reflection-factors are less than white, the idea level of illumination is generally greater than for reading. In addition, it is probable that all specifications of ideal conditions for the performance of critical visual tasks should include adequate rest-periods. In several researches,[4] we have shown

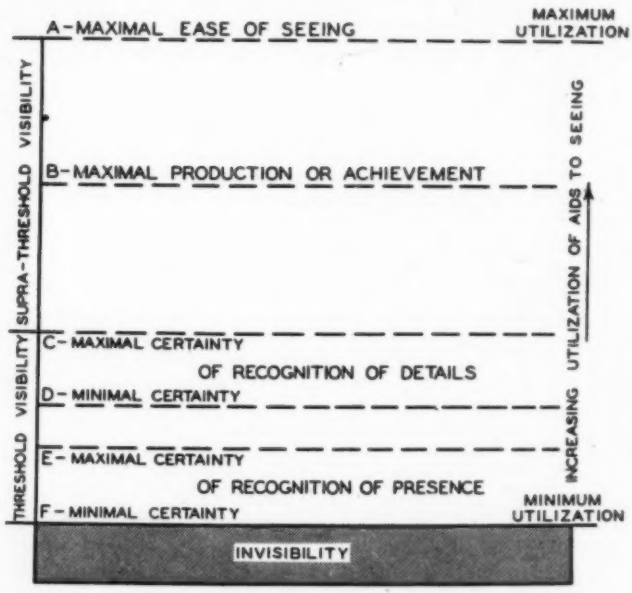

Fig. 1. For any given visual object or task, involving specific seeing conditions, there are six definite levels of seeing. The visual object or task may be raised from one level to another by increasing the utilization of appropriate aids to seeing. The various levels are merely arranged in a systematic order for the purpose of visualization.

that the manifest evidences of ocular fatigue disappear after a few minutes' relaxation from critical seeing.

B. MAXIMAL PRODUCTION OR ACHIEVEMENT: This is also a supra-threshold in seeing determined by human behavior. It may be measured by production of useful work, safety, learning or other well-defined achievements involving seeing. It is a maximum which neglects the cost of seeing to workers considered as human seeing-machines. It is readily measured if merely the approximate maximum is desired. For many common tasks of the work-world involving seeing, a practical maximum is reached when the level of illumination approaches 25 or 30 footcandles. Of course, this level of illumination varies greatly with the character of the visual task, the requirements of performance and the ability of the worker. As has been proved, it cannot indicate the conditions for that higher ideal-maximum ease of seeing. In fact, rate of working, speed of reading, etc., are inadequate criteria of ease of seeing. They do

not include any consideration of the cost of seeing to the human being. For example, presbyopic persons and those with large uncorrected errors in refraction are often able to improve their visual performance by placing a glaring light near to the eyes. In this case, the constriction of the pupil serves to mask the errors of the eyes and thereby to increase the visual efficiency of the observer. Obviously, this gain in visual efficiency is obtained by sacrificing visual comfort.

C. MAXIMAL CERTAINTY OF RECOGNITION OF CRITICAL DETAILS: This is a threshold of visual function. When conditions are such that one does not recognize an object (distinguished by its critical details) every time it is presented to view, it is below the threshold of maximal (or 100 per cent) certainty of seeing. This degree of certainty can generally be attained under ideal conditions with adequate utilization of appropriate aids to seeing. Under most actual conditions, distractions and other factors may cause some failures and reduce the certainty of seeing below the maximal certainty. On the other hand after 100-per cent certainty is attained, any further improvement in the seeing conditions cannot increase the degree of certainty but can contribute toward easier seeing. It has been shown that seeing conditions must be far superior for maximal certainty of seeing than for minimal certainty. For example, under ideal conditions the level of illumination (or brightness) must be ten times greater for the threshold of appropriate maximal certainty than for that of minimal certainty.

D. MINIMAL CERTAINTY OF RECOGNITION OF CRITICAL DETAILS: This is also a threshold of visual function, and usually the threshold involved in researches in the realm of physiological optics. When conditions are such that an object is recognized by its critical or distinguishing details just half the number of times it is presented for recognition, the threshold of minimum certainty is reached. Obviously one could make the same record by guessing. Distractions and other factors may lower the visibility of an object or task below this threshold but it may be restored again to or above this threshold by adequate utilization of appropriate aids to seeing.

E. MAXIMAL CERTAINTY OF DISTINGUISHING PRESENCE OF AN OBJECT: This is a threshold of crude seeing which is useful and even adequate in some situations where safety or the unexpected is involved as on the highway at night, some kinds of inspection, etc. It is just the condition under which the presence of an object can be distinguished every time the object is presented. This is 100% certainty of recognition of presence or absence. This condition is obviously ascertainable but it should be noted that such factors as attention and distraction are influences which can and should be taken into account in all considerations of achievement.

F. MINIMAL CERTAINTY OF DISTINGUISHING PRESENCE OF AN OBJECT: This is the lowest threshold of crude seeing. It is the condition under which the presence of an object can just be distinguished half the times it is presented. We have termed this zero- per cent certainty of recognition of presence (or absence). Obviously, it is an intolerable condition for situations involving production, safety, and comfort of human beings.

The Visibility of Objects

VISIBILITY RELATED TO PHYSICAL FACTORS: If an object is visible, it is by reason of the fact that the size of the object, its contrast with its background, and the brightness of the background exceed certain threshold values. Time available for seeing may be an important factor in some cases but it is not considered here excepting that adequate time is assumed to be available. Complementary relationships exist among these physical characteristics of the object of regard and hence a deficiency in one variable, within certain limits, may be compensated by an augmentation of one or more of the other variables. Although the relationships between these variables are known,[5] these relationships are of little value in determining the visibilities of various objects encountered in the work-world due to the enormous complexity of the calculations which would be involved in such determinations. However, the influence of all visual factors is readily integrated within the visual centers of the brain in the processes of recognition and perception. Thus a subject is able to report the conditions under which he can barely see or recognize a given object; and when aided by a measuring device, such as a visibility-meter, he is able to determine quantitatively the relative visibilities of various dissimilar objects.

The relative visibilities of a variety of objects, as determined with the Luckiesh-Moss Visibility Meter,[3] are presented graphically in Fig. 2. In this case, the relative degrees of supra-threshold visibility of the various objects are indicated in terms of the levels of illumination, respectively, under which all objects would be of equal visibility. For example, it will be noted from Fig. 2 that the visibilities of 12-point type and a black thread on a dark cloth are approximately equal under levels of illumination of 5 and 500 footcandles, respectively. It will also be noted that the recognition of stock quotations requires about twice as high an illumination as the text-matter in the same newspaper notwithstanding the fact that type of the same size is involved in both cases. This fact reveals that the "visibility" of a given object or series of objects depends upon perceptual factors as well as upon the physical characteristics of the printed matter.

The data presented in Fig. 2 are based upon the arbitrary assumption of a standard of visibility equivalent to that provided by 8-point type under an illumination of 10 footcandles. This is a very conservative standard of visibiilty in view of the fact that numerous criteria of ease of seeing indicate the desirability of at least 100 footcandles for such a task.[2] Hence the footcandle values indicated in Fig. 2 are to be considered as relative values rather than recommended levels of illumination for the performance of these critical visual tasks.

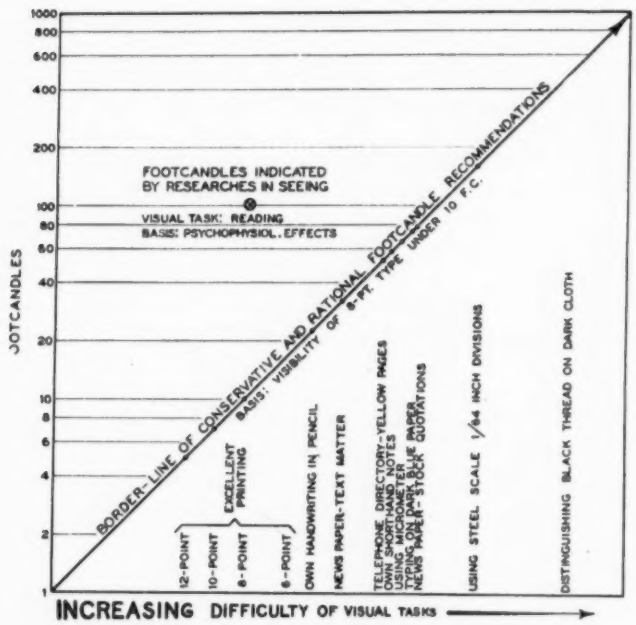

Fig. 2. Illustrating rational footcandle specifications for various visual tasks. These are determined by the relative visibility of each visual task and that of a chosen standard visual task.

It should be obvious that the visibility of a given object or visual task also depends upon the factor of attention. For example, the visibility of a "warning-sign" near dangerous machinery is not necessarily as high for a worker whose sense capacities are involved in many ways as it is for an observer who may direct his entire attention to such a sign. However, this fact is not always considered in appraising the visual conditions under which human beings see and work. These considerations further emphasize the desirability and, in many cases, the necessity for securing the optimum conditions for seeing as indicated in Fig. 1. The latter include adequate "margins of safety" in seeing.

VISIBILITY RELATED TO VISUAL EFFICIENCY: Since the visibility of objects depends very largely upon their contrast with their immediate backgrounds it is obvious that the sensitivity of the human eye in perceiving contrasts is likewise of importance. Notwithstanding this fact, the contrast-sensitivity of the individual is seldom measured in clinical practice. In general, it is more or less tacitly assumed that those individuals who are rated alike, by the criterion of visual acuity, are also alike with respect to their abilities to see objects of low contrast under both high and low levels of illumination. However, it will be shown that such an assumption is far from being a valid one. Furthermore, the necessity for recognizing low contrasts is involved in many visual situations. For example, low contrasts are prevalent outdoors at night or indoors in dimly illuminated interiors. They are also associated with many visual tasks in industry such as inspection, working upon dark materials, etc.

In a recent research[6] we examined a group of 100 adult subjects of various ages and visual abilities by the criteria of visual acuity and contrast-sensitivity, respectively. The former measurements were made with the usual Snellen test-chart, and the latter with a new type of chart, designed by the authors. The latter chart consists of pairs of digits of modified Snellen design reproduced in various degrees of contrast with the dull white background of the chart. These test-objects are approximately equivalent in size to those of the 20/140 line of the Snellen chart when viewed from a distance of 10 feet. However, the size of each digit was individually fixed so that all of the digits used were of the same visibility for the same degree of contrast. In using this chart, the subject was required to correctly report both digits of a given pair thus practically eliminating the possibility of guessing (aided perhaps by some clues) the two-digit number. Since this chart involves very fine gradations in contrast it is impossible to reproduce it here from half-tone plates.

In this particular research, the measurements of visual function were made under a low level of illumination which produced brightnesses of the order of those usually encountered on the highways at night. The data are presented graphically in Fig. 3. Among our one hundred observers, those possessing the keenest vision were able to read line 5 of the A.M.A. Test-Chart under the low level of illumination which prevailed during these measurements. Similarly, other groups of observers were barely able to read lines 6, 7, 8 and 9, respectively. Thus the large letters (E) in Fig. 3 indicate the relative visual acuities of the five groups of observers. The block diagrams below these letters show the degrees of contrast required for the recognition of the test-characters of the Luckiesh-Moss Contrast Chart by the observers in each group possessing the lowest and highest (shaded block) degrees of contrast-sensitivity, respectively.

It will be noted from Fig. 3 that the observers possessing the same visual acuity rating differ markedly in their ability to recognize the low contrast objects of the L-M Chart. For example, the threshold values of contrast varied from 11 to

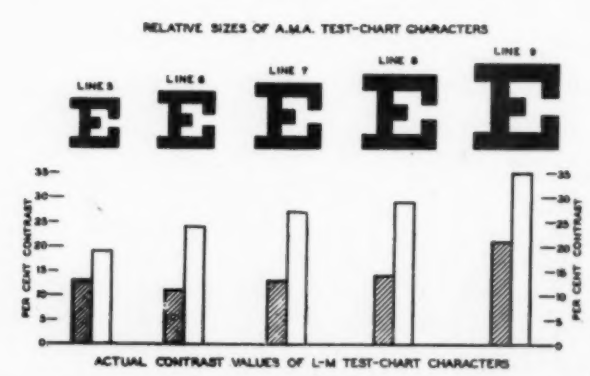

Fig. 3. The five pairs of block diagrams indicate the differences in contrast-sensitivity among observers possessing the same visual acuity rating. Obviously, the observer in each group who required the least contrast between the test-objects and their backgrounds possesses the highest degree of contrast-sensitivity. The large letters (E) indicate the relative visual acuities of the five groups of observers.

24 per cent within the group of observers who were able to "read" line 6 of the A.M.A. Chart. Thus many objects on the highway or in certain industrial situations which would be visible to some of these observers would not be seen by others—yet all would be rated alike by the method of visual acuity. In other cases, the individual differences in contrast-sensitivity might represent the difference between certainty and uncertainty in seeing. Furthermore, since the "visual margins of safety" usually involved in driving or working at night are extremely low, it should be obvious that the contrast-sensitivity of the observer is highly important. These considerations suggest the reason for our distinction between "seeing" and "vision."

Since the recognition of the test-characters of the L-M Contrast Chart involves thresholds of brightness-difference discrimination, there are adequate reasons for assuming that this chart would provide a convenient, inexpensive means for detecting and measuring the degree of night-blindness. The technique of using it for this purpose would be essentially the same as that employed in usual determination of visual acuity with the exception that a controlled period of retinal adaptation would be required in the case of the contrast measurements. Obviously, this technique of appraising or detecting vitamin A deficiency possesses the advantages of simplicity and precision.

Visibility and Ease of Seeing

Visual Functions as Criteria of Fatigue: Numerous attempts have been made to detect and to appraise the degree of ocular fatigue by measurements of visual function such as, for example, the measurement of visibility by means of the visibility meter at frequent intervals during a period of reading. Notwithstanding the fact that the reading was continued in this experiment for more than two hours, no significant changes in the visual abilities of the subjects were observed. Furthermore, extensive researches indicate that the decrement in visual acuity, resulting from a period of eight hours of critical near-vision work, is of the order of two or three per cent.[2] Obviously such a differential in visual function is of no practical use in relating ocular fatigue with the visual conditions under which the critical seeing was performed. With this limitation it cannot be expected even to indicate more deep-seated effects of seeing.

If the brain is as hard a task-master for the eyes as it is known to be for the heart, the failure to detect ocular fatigue by measurements of visual function is easily understandable. As stated by Starling[7] "even when the heart in consequence to disease is scarcely able to carry on the circulation, the arterial pressure (carotid) undergoes little or no alteration. Any other tissue of the body, even the heart itself may suffer, but the brain at all costs must receive its proper supply of blood." It is conceivable that the brain likewise demands clear and effective vision even though the ocular mechanism has been considerably fatigued by prolonged critical visual effort. These concepts are presented diagrammatically in Fig. 4. This possibility is at least in harmony with certain observed facts. For example, it has been shown that no statistically significant difference in visual efficiency results from continuous reading for two hours, although a decrement in convergence reserve of over 12 per cent in prism diopters has been observed after reading only one hour under similar conditions. In other words, the fact that a given visual task is performed with speed and precision is not to be considered as proof that it is performed with ease.

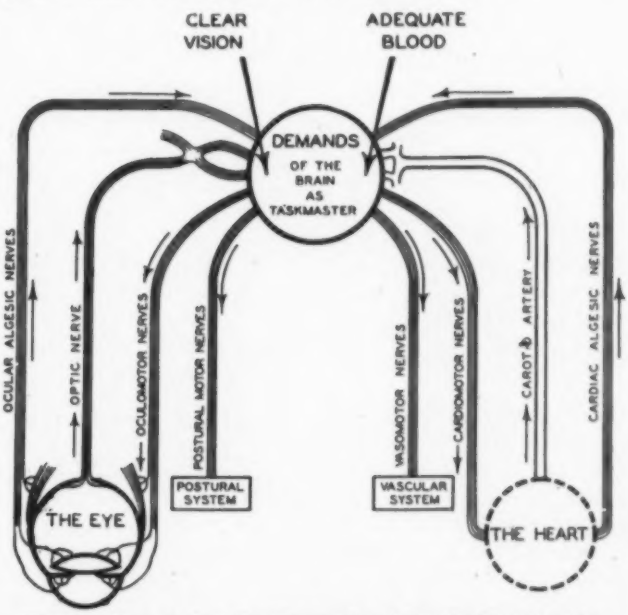

Fig. 4. Comparing the demands of the brain upon the functioning of the heart and eyes, and suggesting a reason for the frequent failure to detect the effects of fatigue by measuring the decrement in visual functions.

The Eyelid Reflex as a Criterion of Ease of Seeing: Although many of the basic laboratory criteria and procedures are too ponderous and complex in the solution of the practical problems of illumination, they are of the utmost value in establishing and in augmenting the significance of those criteria and procedures which may be used for such purposes. Thus in considering the merit of any proposed criterion in applied research, it is axiomatic that a useful one must possess (a) significance from a fundamental viewpoint, (b) adequate sensitivity and (c) the characteristic of reasonable applicability in practice. In the course of our researches, we have carefully investigated numerous criteria from these three viewpoints and have developed two of outstanding merit. These are (1) the measurement of visibility by means of the L-M Visibility Meter and (2) the appraisal of ease of seeing as the latter is revealed by the rate of involuntary blinking. In the laboratory, we have successfully applied many other criteria in appraising the influence of physical factors upon both visibility and ease of seeing. However, all but the two criteria mentioned possess some inherent disadvantages from the practical viewpoint.

A consideration of the possible physiological causes of involuntary blinking leads rather directly to the theory that this activity of the eyelids is related to the degree of "tension" or state of "fatigue" of the subject which exists at the time. It has also been observed that the frequency of blinking is remarkably constant for the individual under constant experimental conditions. The latter characteristic suggested the possibility that the frequency of blinking might serve as a practicable criterion of the visual effort expended in seeing under different experimental conditions. Thus it may be possible to determine the relative degree of comfort (ocular, bodily, mental, etc.) afforded by different qualities of lighting while performing a critical visual task such as reading.

In a recent research,[8] the criterion of the frequency of involuntary blinking was applied as an indication of the relative ocular comfort in reading afforded by different ophthalmic corrections. For example, the data of Table I show that the average frequency of blinking for a group of 30 subjects, while wearing (1) plus ½ diopter spheres, (2) plano lenses and (3) minus ½ diopter spheres in addition to their usual corrections, if any.

TABLE I.

The frequency of the reflex blink as a criterion for determining the efficacy of ophthalmic corrections prescribed according to the usual techniques. These data give the number of blinks occurring during five-minute periods of reading while wearing corrections of +.50 diopter, plano and —.50 diopter, respectively, in addition to the corrections usually worn. The probable errors include the systematic differences in blinking among individuals.

	Additional Corrections		
	+0.50 D	Plano	—0.50 D
Averages for all subjects	37.1	25.9	36.1
Probable Error	2.8	2.0	2.9
Averages for 17 subjects with corrections	36.2	27.3	38.5
Probable Error	4.0	3.1	4.8
Averages for 13 subjects without corrections	38.4	24.1	33.0
Probable Error	3.9	2.5	3.4

Considering the reactions of these subjects as a group, it will be noted that the average rate of blinking is increased by the addition of either the convex or concave spheres. Thus it appears that the exercise of relative accommodation, either positive or negative, while reading involves an expenditure of effort. Hence it is *not* justifiable to assume that the mechanisms of relative accommodation may be employed, *without penalty,* in compensating for some error in prescription. It also appears from the study of individual cases, that the penalty paid for uncorrected refractive errors is excessive in some cases.

In Fig. 5 are summarized the results of typical major researches using the rate of blinking as a criterion of ease of seeing (usually reading). These data and other data from major researches and many minor ones which we have performed in the last decade, dovetail into a consistent and formidable structure. The first set of data in Fig. 5 deal with the effect of footcandles upon the rate of blinking. Next is illustrated the effect of duration of the task. This and the next three were the first researches which we performed in studying the rate of blinking as a possible criterion of ease of seeing. Certainly all will agree that it is "easier" to read (1) at the beginning than after an hour's reading, (2) without glare than with it, (3) with proper eyeglasses than with improper ones, (4) larger type than smaller type.

Data on type-faces[9] have been obtained when

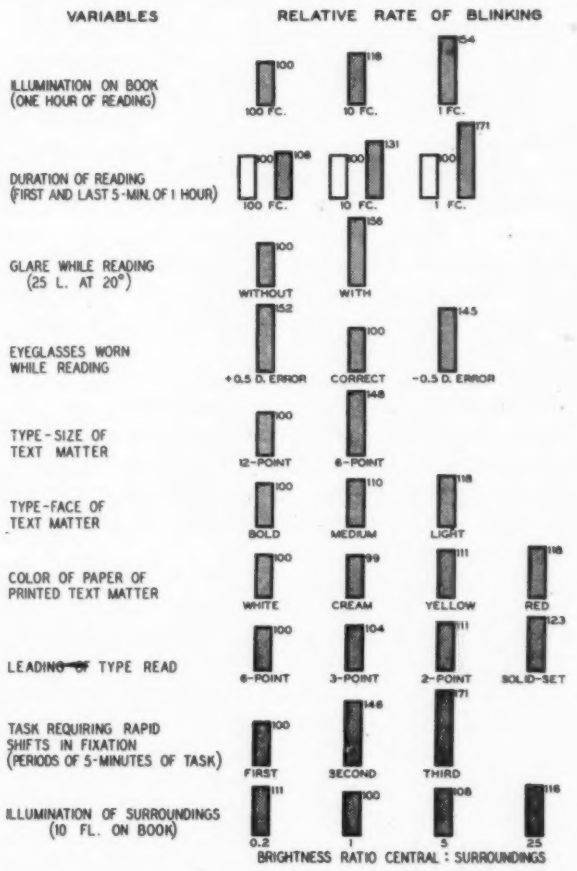

Fig. 5. The relative rates of blinking while reading as various factors which influence visibility and ease of seeing are varied individually.

the apparent differences in style were not adequate to be appraised by the unaided eyes. Our visibility meter determined differences in visibility entirely consistent with the rates of blinking. We have found these criteria sensitive, in certain cases of reading matter printed on tinted papers. When the color is deep enough to reduce the contrast measurably as measured by our visibility meter the ease of reading (readability) is reduced.[10] We have found no measurable advantage of cream or slightly greenish papers over white papers. In fact, no claims of decreased eyefatigue or increased comfort due to tinted papers have been proved by dependable measurements.

We found that our new criterion is the first one apparently sensitive enough to determine the best degree of leading of 10-point type which was used in the research[11] summarized by the eight groups of data in Fig. 5. Following that group is a summary indicating the fatigue or decrease in the rate

of blinking due to rapid shifts in the fixation of the eyes. This has a bearing on many practical aspects of work-world tasks of seeing.

The last group of data pertain to the brightness of the field surrounding the printed page. When the latter is as bright as the immediate surroundings the condition appears to be best. That is, minimum contrast appears to be desirable. This is also a practical aspect in numerous work-world seeing conditions.

These are mere glimpses of many researches[12] we have performed relating visibility and ease of seeing to controllable aids to seeing.

Summary

DURING the course of a quarter of a century of research, we have carefully studied numerous criteria and techniques for the measurement (or appraisal) of the visibility of objects and the ease with which visual tasks are performed. These studies indicate that visibility is readily determinable by means of our visibility meter; and that the frequency of involuntary blinking is a most convenient and sensitive criterion of ease of seeing that has been developed. Both of these techniques possess the practical advantage of applicability to a wide variety of visual situations encountered in the work-world. Furthermore, we have found that ease of seeing as determined by the rate of blinking increases as the visibility of the visual task increases. Therefore, determination of the relative visibility of the task also, in a sense, becomes a determination of the relative ease of seeing. There are some exceptions to this, such as the leading of type, but these are usually obvious. Certainly little progress can be made in easing the load of critical seeing in the work-world and elsewhere without measurements of visibility and influence various controllable aids to seeing have upon visibility.

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Current Literature

William G. Fredrick

A REVIEW of some papers appearing in *Archives des Maladies Professionnelles*, (Volume 2, 1939).

R. Fabre and E. Kahane, **2**, 269-283 (1939), report a toxicological study of the principle constituents of special steels. They consider the toxicological aspects of manganese, chromium, nickel, cobalt, tungolen, molybdenum, vanadium, silicon and titanium, especially from the standpoint of exposures developed around electric furnaces. They conclude that although few observations have been made concerning fume concentrations around steel furnaces, and few cases of occupational poisoning have been reported, more careful attention should be given to this problem, especially since poisoning by silicon, manganese and chromium have occurred in workers exposed to special high temperature operations.

The problem of occupational diseases among welders and brazers is reviewed at length by F. Heim de Balsac and Leroy, **2**, 225-245 (1939). All forms of welding and brazing including butt, flash, resistance and atomic hydrogen are considered, as are the influence of other factors such as welding rods, the material being welded, special fluxes, etc. Ozone and nitrogen oxides are formed in both acetylene and arc welding but the ozone problem is not as important due to the low concentrations usually present. There appears to be no unanimity of opinion as to the exact magnitude of the problem. Little is known about the effect of metal fumes evaporated by the high temperatures of the welding process. Metal fume fever due to zinc oxide and possibly to iron oxide aerosol have been reported. Fluxes and welding rods greatly complicate the toxicity problem by introducing such elements as boron, chlorine, fluorine, silicon, aluminum, manganese, calcium, titanium and vanadium into the picture. In addition many organic materials such as dextrines, sugars, glucosides, etc., are used. Both ultra violet and infra red radiation are produced in abundance during welding. Because of experimental difficulties, very few intensity measurements have been made. The ultra violet is known to be injurious and the infra red intensities are probably in the dangerous region.

A report on 1000 cases of industrial dermatitis studied over a period of five years by Ch. Flandin, H. Rabeau and Mlle. Ukrainczyck, **2**, 284-336 (1939), discusses and illustrates by photographs many types of dermatitis as well as skin tests found useful in diagnosis. 46.9% of all cases observed were produced by contact with chemical substances, 21.6% of which were due to Javelle water and chrome. Among the non-chemical cases, 22.6% were due to seborrhea and 22.6% to other cutaneous conditions. Both sexes ranging in age from 14 to 74 are represented in the study. All cases are tabulated and broken down into occupational groupings as well as type of exposure. A list of 33 common dermatitis producers is given along with proper concentrations for use in skin sensitivity tests. The report includes 59 illustrations.

Pierre Angenot and Robert Charlier report a new research on the toxicity of benzene, **2**, 348-385 (1939). They review the methods available for the determination of benzene in air, and in solutions. Methods which do not alter the benzene include solution in mineral oil and in ammoniacal nickel cyanide, adsorption on activated carbon or silica gel, condensation to liquid or solid benzene with refrigerants and index of refraction measurements with an interferometer. The benzene may be burned to carbon dioxide and so determined by appropriate methods. A large number of procedures are described whereby the benzene is nitrated and then estimated by appropriate gravimetric, volumetric or colorimetric methods. The latter are the most numerous.

The authors determine benzene chemically by nitrating in the cold with mixed acid, under which conditions they found no formation of ortho and para derivatives. The benzene is passed slowly through a tube containing 8 ml.

of a mixture of 1 vol. fuming nitric acid to 2 vol. concentrated sulfuric acid and a second tube containing 4 ml. of the acid mixture. The tubes are kept in an ice-salt bath. The acid is neutralized with 15% sodium hydroxide, the precipitated m-dinitrobenzene is filtered off, washed free of sodium sulfate with water, dried at 40° C. and weighed. The method is applicable to samples containing from 2 to 100 mg. benzene. In the toxicological investigation, the benzene concentration was determined by an absorption spectographic technique. A ilger spectograph, model E-2 and a glass cell, 1 meter long, approximately 50 ml. in volume and equipped at the ends with quartz windows, was used. Readings were made with a Zeiss binocular comparator and a recording microphotometer. A precision of from 0.1 to 4 mg. of benzene was obtained, depending upon care in maintaining uniformity of spectral intensity. The action of various amounts of benzene dislsoved in Ringer's solution on the isolated rabbit intestine was studied. As the concentration of benzene in the solution increased from 50 to 350 mg. per liter, the time required to paralyze the organ decreased markedly. If the time of contact with the benzene solution is not too long, the effect may be made reversible by suitable treatment. The action of solutions of pure benzene on the isolated frog heart was also studied. Concentrations of benzene between 10 and 150 mg. per liter produced no effect either in frequency or emplitude, on the cardiac contraction, even upon 15 minutes infusion. Higher concentrations (250 mg./liter) produced a depression of the cardiac contraction. Concentrations of 250 mg./liter produced serious damage to the myocardiac fibre. Inhalation of pure benzene through the trachea by dogs resulted in a paralysis of the peripheral vasomotor system. A repetition of these tests with commercial benzene showed it to possess a more marked toxic action than pure benzene. A careful fraction of crystallizable commercial benzene into five fractions varying in boiling point from 69 to 81° C. with subsequent analysis showed the principle impurities present to be thoaphene and ethylenic compounds. The fraction distilling between 80.4 and 81.2° C. (3.4% of the whole) exhibited a marked superiority in toxicity to the other fractions. The authors conclude that this increased toxicity is not due to the thiophene present but to other compounds which distill between 80.4 and 81.2° C.

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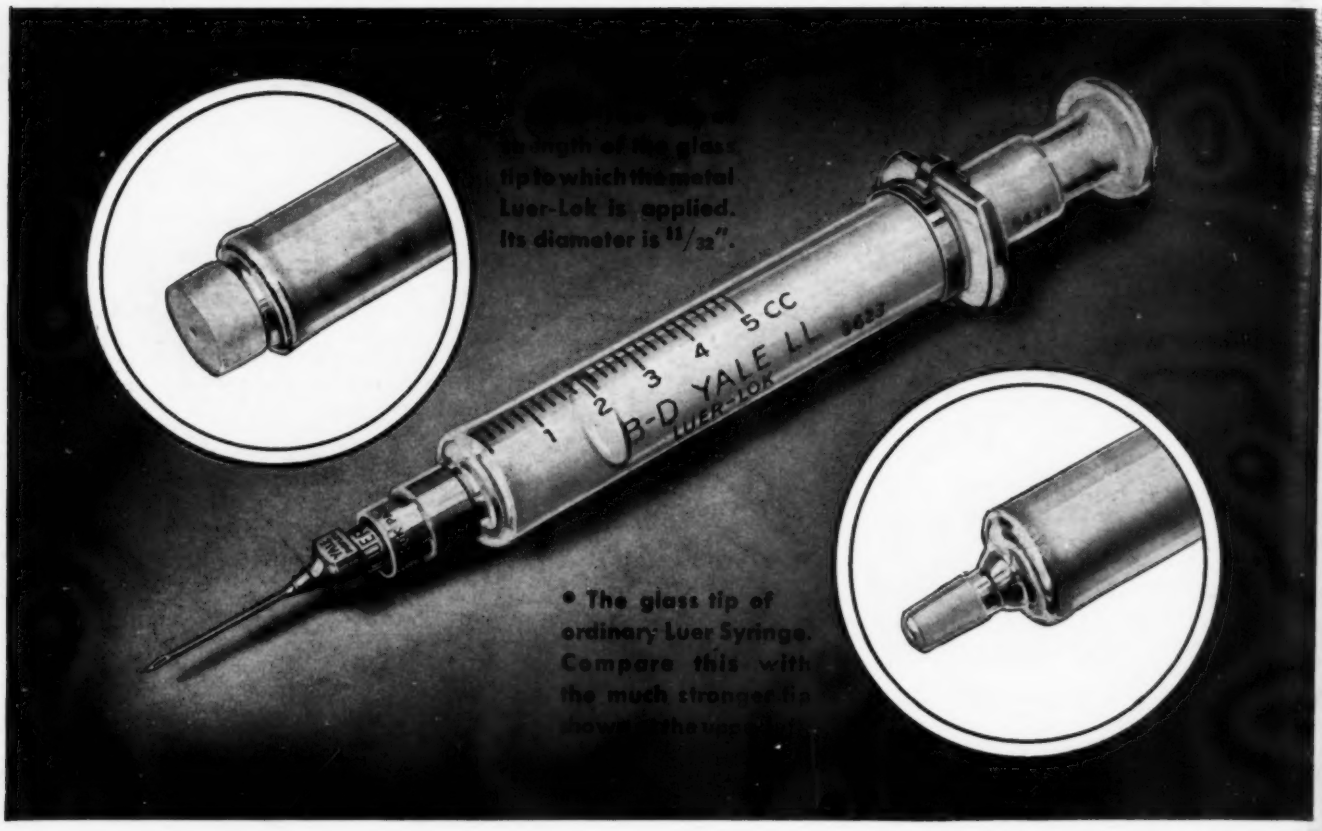
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